

Structural Inequities and Pedagogical Gaps:
Underperformance of South African Mathematics
Teachers
Stephina Modiegi Ntsoane

Abstract: Persistent challenges in South African mathematics education raise important questions about teacher preparedness, pedagogical capacity and the enduring effects of historical educational inequalities. This paper examines how apartheid-era educational policies shaped teacher training and contributed to historically differentiated educational opportunities among South African mathematics teachers. While post-apartheid reforms have expanded opportunities for teacher education and professional development, many educators trained under historically unequal systems entered the profession under substantially different educational conditions. The study engages a decolonial perspective to interrogate how historical injustices continue to shape present-day teacher performance and explores policy implications for addressing these disparities. Drawing on comparative educational data, policy analysis, and insights from inclusive education frameworks, the paper highlights the urgent need for systemic reform, including targeted professional development, infrastructural improvements, and inclusive learning strategies to bridge performance gaps. Ultimately, this research underscores the intersection of historical injustice, teacher preparedness, and classroom environments in shaping South Africa's mathematics education outcomes.

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1. Introduction

Persistent challenges in South African mathematics teaching remain evident despite successive post-apartheid educational reforms. The educational landscape in South Africa presents a complex interplay of historical legacies, systemic inequities, and socio-cultural dynamics that contribute significantly to the persistent challenges affecting mathematics teaching in South Africa. This phenomenon cannot be disentangled from the enduring impacts of colonialism and apartheid, which have shaped both pedagogical practices and teacher training processes. As South African schools strive to enhance mathematical competencies, they face challenges rooted in marginalised educational frameworks that often fail to recognise the diverse cultural contexts of learners.

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This article explores the multifaceted reasons behind this disparity by employing a decolonial perspective, which critiques existing educational paradigms and highlights the urgent need for interventions that not only address academic shortcomings but also promote equitable and culturally relevant teaching methodologies. This article also critically examines the structural and pedagogical factors contributing to this disparity through a decolonial lens. By examining these issues, it becomes imperative to forge pathways that foster both teacher development and student success in mathematics education.

Existing scholarship often focuses on learner performance rather than teacher preparedness shaped by historical inequities. The education landscape in South Africa reflects a complex interplay of historical legacies, socio-economic disparities, and policy challenges that contribute to profound inequalities in educational outcomes. Following the end of apartheid, the nation underwent significant reforms aimed at addressing previous inequities; however, systemic issues persist, particularly in mathematics education. The curriculum's alignment with global standards remains inconsistent, leading to divergent teaching practices among educators, contributing to differences in mathematics education outcomes across African education systems. This disparity is accentuated by a reliance on colonial-era educational paradigms, which often prioritize rote learning over critical thinking and problem-solving skills, a concern reflected in broader critiques of African educational policy orientations shaped by colonial legacies (Tanyu, 2024).

Additionally, the importance of culturally relevant pedagogies, particularly in STEM fields, is underscored by emerging frameworks that incorporate Indigenous knowledge systems, further complicating the educational initiatives in South Africa (Johnson & Khan, 2021). As a result, persistent challenges in South African mathematics teaching can be understood in relation to these systemic inequities and the ongoing influence of colonial legacies on contemporary educational practices.

Mathematics education holds a critical role in the development of cognitive skills and problem-solving abilities, which are necessary for navigating the complexities of the contemporary world, especially in African contexts. The integration of mathematics into the educational curriculum is not merely about numbers; it is about equipping learners to engage in real-world challenges and opportunities. In South Africa, where significant educational inequities persist, the underperformance of learners in math reflects broader systemic issues that require urgent attention. Research has shown that addressing these disparities through innovative curricular strategies, particularly the adaptation of STEM education, can cultivate creativity and critical thinking among students, thereby preparing them for future employment in a rapidly evolving job market (Sincuba, 2024). Moreover, understanding the social constructs and methodologies that influence educational outcomes is essential; thus, incorporating scaffolding strategies can bolster student performance in foundational mathematics (Nunan, 2022).

A decolonial perspective in education challenges the hegemonic narratives and structures established during colonial times, emphasising the need to recognise and rectify historical injustices in knowledge production and pedagogy. This framework advocates for a pluralistic understanding of knowledge systems, encouraging the incorporation of indigenous epistemologies alongside Western paradigms to foster a more equitable educational landscape. By critiquing the Eurocentric norms that dominate curricula, a decolonial approach aims to dismantle the systemic inequities that persist in contemporary educational settings, particularly in regions like South Africa. In doing so, it seeks to empower marginalised voices, offer culturally relevant pedagogies, and promote critical consciousness among learners and educators. Thus, embracing a decolonial perspective is crucial for addressing the disparities that contribute to the persistent challenges in South African mathematics teaching, as it creates a foundation for equitable

educational interventions and reforms (Hlatshwayo, 2000).

In this article, teacher underperformance is not treated as an individual deficit or as a direct measure of teacher ability. Rather, the term refers to documented constraints on mathematics teaching quality and teacher preparedness associated with uneven subject knowledge, unequal access to professional development, resource disparities and historically differentiated teacher-training opportunities. The analysis therefore locates performance within the structural and historical conditions in which mathematics teachers work rather than attributing educational outcomes solely to individual educators.

The examination of persistent challenges in South African mathematics teaching serves a crucial purpose within the broader framework of educational equity and quality. This study highlights the systemic issues rooted in historical, political, and socio-cultural dynamics that continue to influence educational outcomes. By employing a decolonial perspective, the research aspires to unearth the discrepancies in teaching practices and educational standards, elucidating the lingering impacts of colonial legacies and the “certificate syndrome” that prioritises certification over substantive knowledge development (Tanyu, 2024). Furthermore, the significance of this inquiry lies in its potential to inform policy reforms by drawing on successful educational models seen in countries like Namibia and Vietnam, which illustrate effective public education strategies that could be adapted for South Africa (Adamson & Avelar, 2021). Ultimately, this study seeks to forge pathways toward sustainable educational interventions that enhance the professional capacities of mathematics educators in the region.

2. Methodological Approach

This study adopts a qualitative conceptual and desktop-based research approach to examine the historical, structural and pedagogical factors that continue to shape mathematics teaching in South Africa. The study is based on literature synthesis and policy analysis rather than the collection of primary empirical data. This approach enables the study to bring together existing knowledge on educational inequality, teacher preparation, mathematics pedagogy and post-apartheid educational transformation in order to examine how contemporary challenges are connected to historically produced inequalities. In particular, the analysis considers the continuing influence of apartheid education on access to educational opportunities and teacher development, while locating these concerns within wider debates about educational transformation and epistemological access (Hlatshwayo, 2000: 5; Tanyu, 2024: 1).

The documentary material considered comprises peer-reviewed academic literature, education policy and strategic documents, and relevant research reports addressing mathematics education, teacher preparation and professional development, educational inequality, language and learning, inclusive education, culturally responsive pedagogy, ethnomathematics and decolonial approaches to education. Literature addressing the South African context forms the primary basis of the analysis. For example, studies examining mathematics teaching interventions in South Africa provide evidence of the importance of teacher development and pedagogical support (Hazell et al., 2019: 48), while research on language and mathematics highlights the relationship between language proficiency, epistemological access and mathematical learning (Sosibo, 2016). African comparative literature is used selectively to illuminate pedagogical possibilities rather than to establish direct rankings of teacher performance between countries. The Zimbabwean study by Maharaj and Sunzuma (2020: 77), for example, provides an African illustration of how ethnomathematical approaches can connect mathematical knowledge with culturally situated practices.

Sources were selected purposively according to their relevance to the central concerns of the study. Particular attention was given to literature capable of illuminating the relationship between historical educational inequalities, teacher preparation, pedagogical

practice and mathematics education. The selection also included literature addressing contemporary educational reform and emerging approaches to STEM education, as these provide insight into changing expectations of mathematics teaching within African educational contexts (Sincuba, 2024). International and African comparative literature was included where it offered relevant conceptual, pedagogical or policy insights that could be considered in relation to the South African context. The study does not therefore claim to constitute a systematic literature review; rather, it employs a focused synthesis of relevant scholarship and policy-oriented literature to develop a contextualised analysis of the problem.

The selected literature and documentary material were analysed thematically through a decolonial lens. The analysis focused on recurring themes relating to the historical inequalities produced by colonial and apartheid education, disparities in teacher preparation and professional development, language and epistemological access, unequal educational resources, culturally responsive mathematics pedagogy, and the continuing influence of Eurocentric approaches to knowledge and curriculum. The decolonial perspective enables these issues to be interpreted not simply as individual deficiencies among mathematics teachers, but as outcomes shaped by historically unequal systems of education and knowledge production. It further creates space for considering culturally grounded approaches to mathematics teaching, including the incorporation of Indigenous knowledge and ethnomathematical perspectives (Johnson & Khan, 2021; Maharaj & Sunzuma, 2020: 77). In this way, the analysis connects historical conditions, contemporary structural inequalities and pedagogical practices to identify both persistent challenges and possibilities for more equitable mathematics education in South Africa.

3. Historical Context of Mathematics Education in South Africa

The historical context of mathematics education in South Africa is deeply intertwined with the socio-political landscape, revealing systemic inequities that have persisted over decades. Under the apartheid regime, the curriculum was designed to reinforce racial segregation, resulting in distinctly unequal access to quality mathematics instruction across different demographic groups. Schools in predominantly white areas were better resourced and staffed by qualified teachers, whereas those in black communities often faced overcrowded classrooms and insufficient materials, limiting student's educational opportunities. This disparity in educational quality has had longstanding impacts on the mathematics proficiency of learners and, subsequently, the effectiveness of teachers in these communities. As South Africa transitions to a more inclusive educational framework, addressing this historical inequity is crucial for fostering an environment where all mathematics educators can thrive and contribute effectively to their students learning outcomes (Bowie & McKenna, 2021).

The colonial legacy has profoundly shaped the education systems in South Africa, perpetuating inequities that manifest in the classroom today. Historically, colonial powers implemented educational structures designed to suppress indigenous knowledge while elevating Western pedagogies, a pattern that continues to affect teaching efficacy in present-day South Africa. The resultant curriculum often lacks relevance to the cultural and contextual realities of students, contributing to the persistent challenges affecting mathematics teaching in South Africa. These disparities highlight systemic issues entrenched in a culture of limitation, wherein educators and students are marginalised by dominant narratives that favor Eurocentric perspectives over local contexts. As articulated in (Ferfolja & Ullman, 2020), this ongoing impact of socio-cultural discourse not only influences educational policy but also shapes the identities of teachers and students, reinforcing cycles of exclusion. Addressing these inequities requires a critical reevaluation

of existing curricula and a commitment to decolonising education at all levels, as emphasised in (Carroll et al., 2020).

The post-apartheid era in South Africa ushered in a series of educational reforms aimed at rectifying historical disparities and fostering equity in the teaching profession. Despite these initiatives, the effectiveness of these reforms has been contentious, particularly in the realm of mathematics education. The restructured curriculum and professional development programs introduced were intended to elevate teaching standards and outcomes. However, numerous studies indicate that these changes have not sufficiently addressed the complexities of systemic inequities in resource distribution and teacher training, leading to persistent challenges in mathematics teacher preparation and classroom practice in South Africa. The challenges of inadequate infrastructure, insufficiently trained educators, and a lack of contextual relevance in curricula continue to hinder meaningful progress (Bowie & McKenna, 2021). Hence, while post-apartheid reforms signify an important step towards educational equity, their actual impact remains limited in achieving the desired outcomes for mathematics education in the country.

Throughout Africa, historical educational policies have been shaped by unique cultural, social, and economic contexts, leading to significant disparities in educational outcomes across the continent. For instance, South Africa's education system has been heavily influenced by its apartheid past, which entrenched educational inequities along racial lines, resulting in profound challenges such as the uneven mathematics education outcomes when considered within the wider African educational landscape. The human capital theory posits that addressing these systemic inequities is essential for fostering social justice in education, suggesting the need for policy reevaluation that emphasises inclusivity and adaptability in pedagogical strategies. Moreover, recent initiatives in other African countries have integrated technology and STEAM education into their curriculums, promoting critical thinking and problem-solving skills among students, which is crucial in a rapidly evolving global landscape (Sincuba, 2024). As such, understanding these divergent historical policies can inform interventions aimed at enhancing teacher performance and educational quality across South Africa and beyond (Babane et al., 2022).

The role of cultural factors in shaping mathematics education is critical, particularly in the context of South Africa, where diverse cultural backgrounds influence teaching methodologies and learning experiences. Research highlights that integrating students' cultural contexts into mathematics instruction can enhance their engagement and understanding, leading to better educational outcomes. This is evident in approaches such as ethnomathematics, which connect mathematical concepts to cultural practices and learners' lived contexts. Research with mathematics teachers in Zimbabwe, for example, demonstrates how ethnomathematical approaches can be incorporated into the teaching and learning of geometry (Maharaj & Sunzuma, 2020). Although the Zimbabwean context differs from South Africa, this work provides a relevant African example of how culturally grounded mathematical knowledge can inform classroom pedagogy. As South African mathematics teachers grapple with educational challenges, incorporating culturally relevant pedagogies could bridge the gap between traditional methods and the diverse needs of learners, ultimately addressing performance disparities in mathematics education.

4. Factors Contributing to Underperformance

Persistent challenges in South African mathematics teaching arise from several interrelated structural, pedagogical and contextual factors. Foundational literacy and language development are particularly important because learners' ability to engage with mathematical concepts is partly dependent on their capacity to understand the language through which those concepts are taught (Bhila et al., 2020). Learning mathematics through a second language may further complicate access to the specialised terminology

and forms of reasoning required in the subject (Sosibo, 2016). Learner achievement provides important evidence of inequalities within the mathematics education system, but such outcomes cannot be attributed to teacher performance alone. They emerge from intersecting factors including teacher preparation, language of instruction, socioeconomic conditions, school resources and learners' prior educational opportunities. These interconnected conditions therefore need to be considered when examining the challenges experienced by mathematics teachers and learners in historically disadvantaged educational contexts.

Disparities in teacher qualifications and training significantly shape the persistent challenges experienced in South African mathematics teaching. These inequities are rooted in historical injustices and contemporary systemic issues that have led to a misalignment between teacher training curricula and the specific educational needs of diverse learners. As the educational landscape evolves, there is an urgent need to rethink and strengthen existing teacher education frameworks, ensuring they are informed by the complexities of intersectionality, including gender, social identity and regional inequalities (Zhang & Gao, 2024). Furthermore, without targeted investments in equitable public education systems, adequate resource distribution and inclusive educational governance, the full potential of educators cannot be realised (Adamson & Avelar, 2021).

The socioeconomic challenges faced by South African teachers are multifaceted and significantly impact their effectiveness in the classroom, particularly in subjects such as mathematics. Many educators work in underfunded schools, leading to a lack of resources such as textbooks, technology, and adequate classroom infrastructure, which hinders their ability to provide quality education. Additionally, the salary disparities among teachers, compounded by the high cost of living in certain areas, contribute to low morale and decreased motivation among educators (Bowie & McKenna, 2021). This financial strain often forces teachers to seek supplementary income, diverting their attention away from their primary responsibilities. Furthermore, the broader societal issues, such as poverty and crime, exacerbate the challenges faced by teachers, who must navigate these environments while striving to maintain educational standards. Thus, addressing these socioeconomic challenges is crucial for improving the performance of South African mathematics teachers in the context of a broader educational reform.

The variations in educational curricula across African nations significantly impact the effectiveness of mathematics instruction and the subsequent performance of teachers. In South Africa, the curriculum is heavily influenced by the forces of the Fourth Industrial Revolution (4IR), demanding a transformative approach to teacher education that grapples with technological advancements and socio-economic disparities (Babane et al., 2022). However, these modern imperatives often overlook the cultural contexts and lived experiences of students and teachers, which are pivotal in shaping effective learning environments. Meanwhile, education systems in other African countries may prioritise culturally relevant pedagogical strategies that align with local realities, fostering deeper engagement and understanding among learners. These disparities in curricular frameworks not only reflect differing educational values but also highlight underlying inequalities that perpetuate the differences in mathematics education outcomes across African education systems, indicating an urgent need for decolonial interventions that promote equity and relevance in educational practices.

The complex interplay of psychological and emotional factors significantly influences teacher performance, particularly in the context of South African mathematics education. Teachers often grapple with stress, anxiety, and low self-esteem, compounds exacerbated by systemic inequities and cultural misunderstandings within the educational framework. The emotional well-being of teachers not only affects their pedagogical effectiveness but also reverberates through student outcomes, creating a cycle of underperformance.

Furthermore, as discussed in the Handbook of the Cultural Foundations of Learning, understanding the cultural contexts in which teachers operate reveals how these emotional landscapes impact educational equity and participation in the learning process (Ferfolja & Ullman, 2020). Moreover, fostering a supportive environment that addresses these psychological challenges is crucial for enhancing teacher's efficacy and, in turn, student achievement, thereby promoting a more equitable educational landscape (Bowie & McKenna, 2021). Addressing these factors is essential for fostering systemic change and improving the overall quality of education.

5. Interventions and Strategies for Improvement

Addressing persistent challenges in South African mathematics teaching requires targeted interventions and robust strategies that account for local educational inequities. The integration of technology within teacher training programs is critical, as the Fourth Industrial Revolution (4IR) emphasizes the need for teachers to adapt to rapid technological advancements and digital capacities (Babane et al., 2022). Moreover, culturally relevant pedagogy must be embraced to make mathematics more relatable and engaging for students from diverse backgrounds. By grounding instructional approaches in the cultural foundations of learning, educators can create more equitable educational environments that motivate learners and enhance their understanding of mathematical concepts (Maharaj & Sunzuma, 2020). These interventions should not only aim to elevate the competencies of mathematics teachers but also foster a more inclusive educational landscape that acknowledges and bridges systemic disparities, ultimately leading to improved student outcomes and a more just educational system.

Recognising the profound influence of systemic inequities in education, decolonial approaches to teacher training and development are essential for addressing the underperformance of South African mathematics teachers. Such approaches advocate for a reimagining of pedagogical frameworks that prioritise the diverse identities and backgrounds of students, incorporating elements that resonate with their lived experiences. By integrating the concepts of intersectionality, as suggested in (Zhang & Gao, 2024), educators can better understand the multifaceted barriers that affect student engagement and learning outcomes. Furthermore, a decolonial lens encourages the examination of existing educational technologies and methodologies, as highlighted in (Barnes et al., 2024), ensuring that they are designed with an emphasis on equity and social justice. This shift not only empowers teachers but also cultivates an inclusive environment that values all students' contributions, ultimately striving to rectify the disparities observed in educational achievement across different contexts.

A vital component in addressing the educational inequities affecting South African mathematics teachers is the role of community involvement and support systems. Effective educational practices are often sustained through robust community structures that emphasise shared responsibility and collaboration. As evidenced in various contexts, community-centered initiatives can fill the void where formal educational systems falter, enhancing both social cohesion and cultural identity among students, teachers, and families. The resilience of these system adaptations, as discussed in (Vasylieva, et al., 2024), relies heavily on targeted investments and inclusive governance, ensuring that local resources are mobilised effectively. Furthermore, research on designing educational technologies for social justice further suggests that integrating local knowledge and participatory decision-making can improve educational outcomes (Barnes et al., 2024). By fostering environments where community members participate in educational dialogues, the potential for meaningful reform and sustained improvement in mathematics teaching becomes more achievable, promoting equity and empowerment in the process.

In addressing the underperformance of South African mathematics teachers, transformative policy recommendations must prioritise the alignment of educational

frameworks with broader continental objectives. By integrating principles from the African Union's Agenda 2063 and the Continental Education Strategy for Africa (CESA), educational policies can foster a more equitable and effective teaching environment. Research shows that historical and socio-cultural factors, including the remnants of colonial education systems, play a significant role in this underperformance (Tanyu, 2024). Therefore, reforms should focus on enhancing teacher training and professional development, ensuring that curricula are responsive to local contexts, and prioritising critical thinking over mere certification. Evidence from other countries, such as Namibia and Brazil, demonstrates successful public education strategies that could serve as models for South Africa (Adamson & Avelar, 2021). Ultimately, comprehensive reforms should seek to build a robust support system for mathematics educators, fostering not only improved academic outcomes but also sustained socio-economic growth.

Successful case studies provide valuable insights into how systemic educational interventions can enhance mathematics teaching and learning outcomes. For instance, the R-Maths intervention in South Africa in the Western Cape province demonstrated that well-structured teacher training, combined with tailored instructional materials, led to a significant improvement in learner performance by 2.9 percentage points over a comparative group, reinforcing the idea that targeted interventions can yield measurable results in mathematical competencies (Hazell et al., 2019). Similarly, instructional design initiatives in countries such as Mexico and South Africa illustrate the potential for equitable educational practices, emphasising the importance of fostering students' reasoning through carefully crafted learning sequences, particularly for historically marginalised groups (J Cortina et al., 2019, p. 16-28). These examples not only highlight effective methodologies but also underscore the necessity for contextual adaptations to meet local educational challenges, paving the way for transformative approaches in South African mathematics education.

6. Conclusion

In conclusion, persistent challenges in South African mathematics teaching reflect systemic educational inequities that continue to affect teaching quality and learner outcomes. These challenges are rooted in historical, socio-economic and pedagogical factors that continue to shape teacher preparation, classroom practice and educational outcomes in South Africa. Rather than locating underperformance primarily within individual teachers, a decolonial perspective draws attention to the unequal educational structures inherited from colonialism and apartheid and prompts a re-evaluation of curricula and pedagogical approaches that may continue to reproduce these legacies. Moreover, targeted interventions must address not only teacher training and resources but also the broader socio-cultural contexts that shape education in diverse communities. By recognising the complex interplay of these factors, stakeholders can develop comprehensive strategies that empower teachers and strengthen the quality of mathematics education. Ultimately, fostering equitable educational opportunities is crucial for enhancing learner achievement and ensuring that all learners can thrive in a globalised knowledge economy (Bowie & McKenna, 2021).

The analysis highlights persistent challenges in South African mathematics teaching that are closely connected to historical and structural educational inequalities. Key findings indicate that these disparities are closely linked to historical legacies of colonial education systems, which perpetuate educational inequities and hinder effective teaching practices. Broader debates concerning the alignment of African education policies with continental transformation agendas such as Agenda 2063 further illustrate the importance of situating educational reform within Africa's changing policy environment (Tanyu, 2024). Comparative examples from other education systems provide possible policy lessons for South Africa. Public education experiences documented in countries such as Namibia and

Vietnam illustrate different approaches to promoting equitable access and strengthening public education, although these approaches need to be considered in relation to South Africa's distinctive historical and educational context (Adamson & Avelar, 2021). These findings underscore the urgent need for targeted interventions aimed at enhancing teaching quality and fostering a more inclusive educational landscape in South Africa.

6.1. Limitations and Future Research

As a desktop-based study drawing primarily on existing literature and policy analysis, this research does not provide primary empirical evidence of how historical differences in mathematics teacher preparation are currently manifested in classroom practice. This represents an important area for further investigation. Although existing scholarship demonstrates the continuing significance of historical inequality, teacher preparation, language, resources and pedagogical context in South African mathematics education, there remains a need for empirical research that examines how these factors interact within contemporary mathematics classrooms. In particular, further research is needed to establish how differences in teachers' educational and professional preparation influence pedagogical practices across different school contexts and whether targeted professional-development interventions produce sustained improvements in teaching practice and learner outcomes.

A second important research gap concerns the practical implementation of decolonial approaches to mathematics education. While decolonial and culturally responsive perspectives provide important conceptual grounds for questioning inherited curricula and recognising Indigenous and culturally situated forms of mathematical knowledge, there remains limited evidence within the scope of the literature examined in this study regarding how such approaches are implemented in South African mathematics classrooms and how teachers and learners experience them. African research on ethnomathematics demonstrates the potential value of connecting mathematical concepts with culturally situated knowledge and practices (Maharaj & Sunzuma, 2020: 77). However, further South African classroom-based research is needed to examine how decolonial mathematics pedagogies can be translated from conceptual principles into teaching practices and how their implementation may influence teaching quality, learner participation and mathematics achievement.

Mixed-methods research would be particularly valuable in addressing these unresolved questions because the challenges identified in this study involve both measurable educational outcomes and context-dependent experiences of teaching and learning. Quantitative evidence could be used to examine patterns in mathematics teachers' subject knowledge, pedagogical practices, participation in professional-development programmes and learner achievement, while qualitative interviews and classroom observations could provide deeper insight into teachers' experiences of training reforms, the implementation of decolonial pedagogical approaches and the contextual conditions that facilitate or constrain their classroom practice. Integrating these forms of evidence would enable future studies to examine not only whether changes in teaching quality and learner outcomes occur, but also how and within what educational conditions such changes take place. This would be particularly important in the South African context, where mathematics teaching is shaped by intersecting historical, socioeconomic, linguistic and institutional inequalities.

In addition to mixed-methods research, longitudinal designs would be particularly valuable for determining whether improvements associated with teacher-training and professional-development interventions are sustained over time and whether they correspond with longer-term improvements in teaching quality and learner mathematics achievement. Research evaluating mathematics interventions in South Africa has already demonstrated the importance of examining teacher development and pedagogical support

within particular educational contexts (Hazell et al., 2019: 48). Building on such work, future research should follow teachers and learners over extended periods and across differently resourced schools to establish how teacher-training reforms and decolonial pedagogical approaches operate under varying socioeconomic, linguistic and institutional conditions.

Such research would help address the current gap between conceptual arguments for educational transformation and empirical evidence of their longer-term effects. It would also provide a stronger evidence base for determining which forms of teacher development and decolonial mathematics pedagogy contribute to meaningful and sustainable improvements in teaching quality and learner achievement, while recognising that educational outcomes are shaped by multiple structural and contextual factors rather than teacher practice alone.

REFERENCES

1. Adamson, F. & Avelar, M. (2021). *Public education works: Lessons from five case studies in low- and middle-income countries*. Available at: <https://www.gi-escr.org/publications/working-paper-public-education-works-lessonsfrom-five-case-studies-inlow-and-middle-income-countries>
2. Babane, C.V., Kadenge, E., Krishnannair, A. et al. (2022). *The 4IR and teacher education in South Africa*. AOSIS. Available at: <https://core.ac.uk/download/548537290.pdf>
3. Bhila, T., Mataka, T.W. & Mukurunge, T. (2020). *Reading to learn (RTL) through story books: Moving beyond physical school access to epistemological access in a Grade R classroom in the Eastern Cape, South Africa*. Available at: <https://www.semanticscholar.org/paper/8aa0d9d376edd68338d418b225f6c96270c1a06e>
4. Barnes, K., Emerusenge, A.P., Rabi, A., Ullah, N., Mazari, H., Moustafa, N., Thakrar, J. et al. (2024). *Designing for Social Justice: A Decolonial Exploration of How to Develop EdTech for Refugees*. *Education Sciences*, 14. Available at: <https://www.mdpi.com/2227-7102/14/1/77>
5. Bowie, C. & McKenna, S. (2021). *Understanding Higher Education*. African Books Collective.
6. Carroll, S.R., Kukutai, T., Rodriguez-Lonebear, D. & Walter, M. (2020). *Indigenous Data Sovereignty and Policy*. Routledge. Available at: <https://doi.org/10.4324/9780429273957>
7. Cortina, J., Jšňovská, V., Graven, M. & Vale, P. (2019). *Instructional design in pursuing equity: The case of the 'fraction as measure' sequence*, pp. 16–28.
8. Ferfolja, T. & Ullman, J. (2020). *Gender and Sexuality Diversity in a Culture of Limitation*. Available at: <https://doi.org/10.4324/9781315161686>
9. Hazell, E., Spencer-Smith, G. & Roberts, N. (2019). *Improving Grade R mathematics teaching in South Africa: Evidence from an impact evaluation of a province-wide intervention*. *Journal of Education (University of KwaZulu-Natal)*, 76, pp. 48–68.
10. Hlatshwayo, S.A. (2000). *Education and Independence*. Praeger.
11. Johnson, M. & Khan, M. (2021). *Indigenous Australian STEM in K-12 Classrooms: A Narrative Literature Review*. NSW Department of Education.
12. Maharaj, A. & Sunzuma, G. (2020). *Exploring Zimbabwean mathematics teachers' integration of ethnomathematics approaches into the teaching and learning of geometry*. *Australian Journal of Teacher Education*, 45, pp. 77–93.
13. Nunan, J.S.R. (2022). *Factors Influencing Rural Foundation Phase Learners' Underperformance in Reading and Mathematics in Primary Schools in South Africa: Teacher Perspectives*. *Curriculum and Teaching*.
14. Sincuba, L. (2024). *Sustainable and Impactful Education: Community Development within the Fourth Industrial Revolution (4IR) in South Africa: STEAM Evaluation*. *Journal of Education and Learning Technology*.

- 15.** Sosibo, Z. (2016). *Performance, Proficiency and Language: Exploring Factors Contributing to Second-Language Students' Excellence in Mathematics*.
- 16.** Tanyu, N.R. (2024). *New Approaches to Higher Education Policy Orientation in Africa: An Assessment of the African Union's 2063 Agenda within the Context of the Central African Economic and Monetary Community*.
- 17.** Zhang, A.Y. & Gao, G. (2024). *Intersectionality in Educational Psychology and Curriculum Studies: A Critical Review*. *Educational Research*, 4, pp. 1–14. Available at: <https://doi.org/10.21467/exr.4.1.5387>

Stephina Modiegi Ntsoane, PhD.

Department of Political Sciences, University of South Africa