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Mathematics Teacher Leadership: Advocating for Equity and Excellence: A Case Study of Five Secondary Schools in the OR Tambo Coastal District of South Africa

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ABSTRACT

This study aims to explore the role of mathematics teacher leaders in promoting equity and academic excellence in five secondary schools situated in the OR Tambo Coastal District, South Africa. It investigated how these educators advocate for improved mathematics instruction, fair access to learning, and learner achievement within historically and socio-economically disadvantaged settings. A qualitative case study design was employed, involving purposive sampling of fifteen teacher leaders. Data collection included semi-structured interviews, classroom observations, and document analysis, with thematic analysis guiding the interpretation of findings. The research is underpinned by Mezirow's Transformative Learning Theory, which posits that deep learning emerges from critical reflection on beliefs and experiences, leading to changed perspectives. Findings revealed that teacher leaders play a crucial role in enhancing instructional quality and equity by mentoring peers, promoting inclusive teaching practices, and leading collaborative initiatives. They adapt pedagogical approaches to suit diverse learner needs, fostering more responsive and effective classroom environments. However, teacher leaders continue to face significant obstacles, such as insufficient institutional recognition, lack of consistent professional support, and ongoing socio-economic challenges faced by learners. To address these issues, the study recommends formal recognition of teacher leadership roles, targeted training in equity-oriented pedagogy, and stronger collaboration between schools and education authorities. The study contributes to scholarship on educational leadership by offering context-specific insights into how teacher leaders in under-resourced schools can drive systemic improvements in mathematics education. It extends the discourse on distributed leadership and equity, showing how grassroots leadership can overcome structural barriers and promote transformative educational outcomes.

Keywords: Mathematics, Leadership, Transformative Learning, Education, Equity, Excellence

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INTRODUCTION

In recent decades, the role of teacher leadership has gained prominence as a catalyst for improving teaching quality, student outcomes, and systemic change in schools. In the field of mathematics education, where persistent performance gaps and access inequalities prevail, teacher leaders are increasingly recognised for their potential to lead instructional improvement, foster professional collaboration, and promote equity in learner outcomes. This is especially relevant in the South African context, where educational disparities remain stark, particularly between historically advantaged and

disadvantaged communities. Despite ongoing reforms, the mathematics performance of learners in many rural and township schools continues to reflect deep-rooted socio-economic and institutional inequalities. Research indicates that mathematics teachers who engage in professional learning communities and work with their peers are better equipped to address equity issues.[1] While existing literature acknowledges the impact of school leadership and professional learning communities on academic performance, there is limited empirical research focusing specifically on how mathematics teacher leaders in under-resourced schools advocate for both equity and excellence in their practice. Studies show that strong mathematics leadership can result in better student results, especially for marginalised students, emphasising the vital connection between leadership, equity, and quality education.[2] This gap is especially notable in rural districts like OR Tambo Coastal, where systemic challenges such as resource limitations, large class sizes, and contextual diversity intensify the demand for responsive and transformative leadership at the classroom level. The primary objective of this study is to explore how mathematics teacher leaders in five secondary schools within the OR Tambo Coastal District contribute to promoting equitable and high-quality mathematics education. It investigates their leadership practices, challenges faced, and the broader implications for school improvement and policy development. Collaborative endeavours are crucial for creating a standard comprehension of how inquiry-based learning can intersect with equity, resulting in more inclusive teaching methods.[3] The study proceeds with the following thematic structure: a review of relevant literature on teacher leadership and equity in mathematics education; a discussion of the theoretical framework grounded in Mezirow's Transformative Learning Theory; a detailed account of the research design and methodology; presentation and analysis of findings; followed by a discussion of implications, recommendations for practice and policy, and the study's contribution to educational scholarship.

LITERATURE REVIEW

This section explores the different elements that impact the effectiveness of mathematics teacher leadership in promoting fairness and excellence. It investigates how mathematics teacher leaders can initiate change, the need for professional development training for mathematics teachers, support from school leaders to empower them to drive change, inadequate resources, and successful methods to aid all students in mathematics education.

Mathematics Teacher Leaders as Catalysts for Transformative Change

Mathematics teacher leaders are crucial in driving positive educational change by promoting collaboration, modelling best practices, and advocating for equity. They articulate a clear vision for improvement and align it with school and district goals to provide a roadmap for change. These leaders cultivate collaboration among colleagues through mentoring, PLCs, and collaborative planning, creating an environment of support and shared commitment to improvement. By exemplifying excellence in instructional practices and prioritising their professional growth, teacher leaders inspire their colleagues to adopt effective methods. They also advocate for equitable resources and inclusive practices to ensure all students succeed in mathematics. Mathematics teacher leaders have a lasting impact on the broader educational community through their involvement in curriculum development, policy shaping, and stakeholder engagement.

Mathematics teacher leaders are crucial in bringing about significant change in educational systems, especially when advocating for equity and high standards in mathematics education. Their responsibilities include improving teaching methods and promoting changes in the system to address disparities in opportunities and results for various student groups. Studies show that successful

[1] Amanda Jansen, "Entangling and Disentangling Inquiry and Equity: Voices of Mathematics Education Professors and Mathematics Professors," *Journal of Urban Mathematics Education* 16, no. 1 (2023): 10–39; Jinhee Kim, "Leading Teachers' Perspective on Teacher-AI Collaboration in Education," *Education and Information Technologies* 29, no. 7 (May 1, 2024): 8693–8724, https://doi.org/10.1007/s10639-023-12109-5.

[2] Mashod, Mohd Khairul Azam Hj Ali, Dk Nurul'Izzati Pengiran Omar, Nadiah Maimunah Khanafiah, Nurul Hafizah Haji Alias, Sil Yin Tan, Ani Afifah Haji Mosli, Nor Azura Abdullah, and Masitah Shahrill. "The perceived ideal qualities of secondary school mathematics leaders." *Journal of Honai Math* 5, no. 1 (2022): 15-28.

[3] Jansen, "Entangling and Disentangling Inquiry and Equity: Voices of Mathematics Education Professors and Mathematics Professors."

mathematics teacher leaders promote professional development in their colleagues through collaborative activities, leading to a culture of ongoing enhancement and creativity in teaching strategies.[4]

One crucial element of being a mathematics teacher leader is understanding and dealing with the intricate connection between race, gender, and socio-economic factors that impact students' learning in mathematics. Research has indicated that teachers' beliefs about why students succeed or struggle substantially influence how they teach and interact with their students.[5] Mathematics teacher leaders can help their colleagues develop fairer teaching methods that acknowledge and meet the various needs of all students by promoting an understanding of these beliefs.[6] This is especially crucial considering the prevalent narratives that frequently overlook the experiences of minority groups in mathematics education.[7]

Furthermore, mathematics teacher leaders are key in advocating for inquiry-based learning and promoting equitable instructional methods. Participating in professional learning communities enables these leaders to work together to examine the connections between inquiry and equity, thus improving their teaching methods and creating a more diverse learning atmosphere.[8] Combining technology and new teaching methods like flipped classrooms enhances mathematics teachers' ability to change classroom dynamics and improve student involvement.[9] This change is crucial in ensuring educational experiences that are academically challenging, culturally appropriate, and meaningful to students' experiences. Yet, despite the acknowledged significance of mathematics teacher leadership in instigating revolutionary change, there are still notable deficiencies in the training and assistance provided to these leaders. Numerous mathematics teacher training programmes fail to adequately cover the challenges of equity and social justice in their courses, leaving future teachers ill-prepared to handle these critical issues in their work.[10] Additionally, it is essential to continue professional development that highlights the ethical aspects of mathematics education, motivating teacher leaders to see equity as a continuous journey rather than a fixed objective.[11]

Empowering Mathematics Teachers Through Professional Development

Professional development is crucial for mathematics teachers to enhance their effectiveness in the ever-evolving field of education. It focuses on deepening teachers' content knowledge, allowing them to confidently address complex topics and nurture students' understanding. Additionally, professional development enhances pedagogical skills by introducing innovative teaching methods like differentiated instruction and technology integration to engage students effectively. It also promotes inclusivity by providing training on supporting students with diverse learning needs through UDL and IEPs. Collaboration is fostered among teachers through workshops and conferences, enabling the sharing of best practices and continuous improvement. Technology integration in mathematics education and hands-on training on digital tools are also emphasised. Professional development empowers teachers to create a dynamic, inclusive learning environment that prepares students for future challenges. Schools must prioritise continuous learning to ensure their mathematics programs remain relevant and practical. Providing professional development (PD) is essential for empowering mathematics teachers and improving their teaching skills and student achievements. Studies show organised professional development programs can significantly influence teachers' skills and teaching methods. According to

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[4] Laurie H. Rubel, "Equity-Directed Instructional Practices: Beyond the Dominant Perspective," *Journal of Urban Mathematics Education* 10, no. 2 (December 29, 2017), https://doi.org/10.21423/jume-v10i2a324.

[5] Nchima Freddy Mashapa, *Mathematics Heads of Departments as Instructional Leaders in Limpopo Secondary Schools* (University of Pretoria (South Africa), 2019).

[6] Jennie Golding, "The Development of Teachers of Mathematics in Sub-Saharan Africa: Reflections on Moving Forward with Confidence," in *Mathematics Teacher Training and Development in Africa: Trends at Primary and Secondary School Levels* (Cham.: Springer Nature Switzerland, 2024), 253–69, https://doi.org/10.1007/978-3-031-68755-6_13.

[7] Rubel, "Equity-Directed Instructional Practices: Beyond the Dominant Perspective."

[8] Jansen, "Entangling and Disentangling Inquiry and Equity: Voices of Mathematics Education Professors and Mathematics Professors."

[9] Mustafa Cevikbas and Gabriele Kaiser, "Flipped Classroom as a Reform-Oriented Approach to Teaching Mathematics," *ZDM* 52, no. 7 (December 7, 2020): 1291–1305, https://doi.org/10.1007/s11858-020-01191-5.

[10] Rubel, "Equity-Directed Instructional Practices: Beyond the Dominant Perspective"; Golding, "The Development of Teachers of Mathematics in Sub-Saharan Africa: Reflections on Moving Forward with Confidence."

[11] Mark Boylan, "Deepening System Leadership," *Educational Management Administration & Leadership* 44, no. 1 (January 28, 2016): 57–72, https://doi.org/10.1177/1741143213501314.

Leton et al., working together as teachers can enhance their mathematics teaching abilities, leading to improved mathematics performance by students.[12] Chapman and Koh's findings support the idea that mathematics teachers need strong professional skills to use teaching methods like Lesson Study effectively.[13]

Additionally, Wood et al. emphasised the importance of discipline-specific methods for professional development in mathematics education, as the distinct obstacles mathematics teachers encounter necessitate personalised assistance.[14] Dicdiquin et al. also emphasise the importance of effective PD programmes in overcoming challenges in mathematics instruction and building teachers' confidence and knowledge in the subject.[15] Driskell et al. emphasise integrating technology into professional development to help teachers effectively incorporate digital tools in mathematics education. The format and delivery of PD often determine its effectiveness.[16] Yoon argues that consistent professional development is more advantageous than occasional workshops, as it encourages a deeper understanding and implementation of teaching strategies.[17] Similarly, Borko, Jacobs and Koellner examined how video is utilised in practice-based professional development, enabling teachers to analyse and ponder their teaching collectively.[18] This approach improves teachers' grasp of teaching methods and fosters a culture of ongoing improvement among teachers. Additionally, Al-Matroushi and Alkiyumi emphasised the importance of leadership in promoting sustainable professional development.[19] They discovered that educational supervisors' transformational leadership behaviours significantly impact the professional development of mathematics teachers. This indicates that having supportive leadership is crucial for establishing a conducive environment for effective PD.

Enabling Transformative Leadership in Mathematics Education

Transformative leadership in mathematics education relies on school leaders empowering teacher leaders to drive change. Teacher leaders are essential for boosting innovation, improving practices, and fostering collaboration. For success, teacher leaders need support and resources from school leadership. School leaders can empower mathematics teacher leaders with tailored professional development opportunities to enhance leadership skills and subject expertise. Autonomy and trust are crucial for fostering transformative leadership and encouraging innovation and ownership. Facilitating transformational leadership in mathematics education is vital for creating a culture that promotes new ideas, working together, and enhancing teaching methods. Transformational leadership emphasises inspiring and motivating teachers and is crucial in improving the quality of mathematics instruction and educational results.

Studies by Leithwood and Sun emphasised the importance of transformational leadership in enhancing school teaching methods.[20] They claim that strong leadership is essential for improving schools' " technical core, " including teaching and learning procedures. Al-Husseini et al. agree with this viewpoint, stating that transformational leadership encourages knowledge sharing among staff

[12] S. I. Leton, Y. O. Jagom, and W. B. N. Dosinaeng, "Math Study Habits of Deaf Learners," *Journal of Physics: Conference Series* (IOP Publishing, October 2020).

[13] O. Chapman and K. Koh, "STEM, Online, and Innovative Mathematics Teaching Strategies for All Students," *Journal of Mathematics Education* 15, no. 1 (August 1, 2022): 1–15, https://doi.org/10.26711/007577152790080.

[14] Dustin Wood et al., "Response Speed and Response Consistency as Mutually Validating Indicators of Data Quality in Online Samples," *Social Psychological and Personality Science* 8, no. 4 (May 7, 2017): 454–64, https://doi.org/10.1177/1948550617703168.

[15] Juana B Dicdiquin, Froilan D Mobo, and Anesito L Cutillas, "Evaluating the Effectiveness of Professional Development Programs for Junior High School Mathematics Teachers in Improving Mathematics Instruction in the K to 12 Curriculum in the Philippines.," *International Journal of Multidisciplinary: Applied Business and Education Research* 4, no. 4 (2023): 1143–53.

[16] Tripp Driskell, Eduardo Salas, and James E. Driskell, "Teams in Extreme Environments: Alterations in Team Development and Teamwork," *Human Resource Management Review* 28, no. 4 (December 2018): 434–49, https://doi.org/10.1016/j.hrmr.2017.01.002.

[17] Jaehong Yoon et al., "Lifelong Learning with Dynamically Expandable Networks," *ArXiv Preprint ArXiv:1708.01547*, 2017.

[18] Hilda Borko, Jennifer Jacobs, and Karen Koellner, "Contemporary Approaches to Teacher Professional Development," *International Encyclopedia of Education* 7, no. 2 (2010): 548–56.

[19] Said Al-Matroushi and Mohammed Al-Kiyumi, "Impact of Transformative Leadership Practices of Educational Supervisors on the Sustainable Professional Development of Mathematics Teachers," *Journal of Educational and Social Research* 12, no. 1 (January 3, 2022): 261, https://doi.org/10.36941/jesr-2022-0021.

[20] Kenneth Leithwood and Jingping Sun, "The Nature and Effects of Transformational School Leadership," *Educational Administration Quarterly* 48, no. 3 (August 17, 2012): 387–423, https://doi.org/10.1177/0013161X11436268.

members, which in turn helps in curriculum innovation and development.[21] Collaborative settings are very advantageous in mathematics education, as teachers can exchange top practices and methods for successfully implementing curricula based on standards.

In addition, Alessa's comprehensive analysis highlights the benefits of transformational leadership in improving organisational performance within educational environments.[22] The research shows that transformational leadership significantly enhances employee motivation and engagement, improving academic performance, particularly in mathematics education.[23] This is like what Balwant found, as he stresses the significance of transformational teacher-leadership in moulding students' views and experiences in college, impacting their involvement and achievement in mathematics classes.[24]

Transformational leadership has a wide-ranging impact beyond individual classrooms to the more extensive educational system. Palar, Lumapow, Wullur, and Usoh show that school principals implementing transformational leadership styles substantially impact education quality and ultimately enhance student results.[25] This is also backed up by Samad et al., who discovered that transformational leadership practices play a role in teachers' feelings of efficacy, which is key for successful mathematics teaching.[26]

Furthermore, incorporating transformational leadership principles into professional development initiatives for mathematics teachers can improve their teaching techniques. McGee and Nutakki highlighted the importance of professional development through transformational leadership, which helps teachers effectively utilise standards-based pedagogies.[27] This method gives teachers more power and promotes a collaborative environment necessary for tackling the challenges in mathematics education.

Bridging the Gap: Tackling Inadequate Resources in Education

Lack of educational resources, especially in mathematics, poses significant challenges for teachers and students. Outdated textbooks, limited technology access, and poor infrastructure hinder quality instruction and engagement in learning. These resource shortages disproportionately affect underserved and rural communities, exacerbating educational disparities. Teachers must find innovative solutions to overcome these deficiencies, such as creating materials or seeking external support. The uneven distribution of resources, especially in urban versus rural regions, has been a central focus of studies in education.

Solving this problem necessitates a comprehensive strategy involving strong leadership, strategic allocation of resources, and creative educational methods.Tang, Ren, and Zhao's research highlights how regional economic growth influences the equitable allocation of educational resources.[28] Tang et al. contended that differences in the distribution of teachers and resources in urban and rural areas negatively impact the overall quality of education.[29] Moreover, they discussed problems in resource allocation for compulsory education in China, emphasising the importance of optimised strategies for

[21] Sawasn Al-Husseini, Ibrahim El Beltagi, and Jonathan Moizer, "Transformational Leadership and Innovation: The Mediating Role of Knowledge Sharing amongst Higher Education Faculty," *International Journal of Leadership in Education* 24, no. 5 (September 3, 2021): 670–93, https://doi.org/10.1080/13603124.2019.1588381.

[22] Ghuzayyil Saad Alessa, "The Dimensions of Transformational Leadership and Its Organizational Effects in Public Universities in Saudi Arabia: A Systematic Review," *Frontiers in Psychology* 12 (November 10, 2021), https://doi.org/10.3389/fpsyg.2021.682092.

[23] Saad Alessa, "The Dimensions of Transformational Leadership and Its Organizational Effects in Public Universities in Saudi Arabia: A Systematic Review."

[24] Paul T. Balwant, "Transformational Instructor-Leadership in Higher Education Teaching: A Meta-Analytic Review and Research Agenda," *Journal of Leadership Studies* 9, no. 4 (February 23, 2016): 20–42, https://doi.org/10.1002/jls.21423.

[25] Hendrie J Palar et al., "The Influence of Transformational Leadership and Democratic Leadership on Quality of Education at Manado State Polytechnic, North Sulawesi," *International Journal of Applied Research* 9, no. 6 (June 1, 2023): 130–35, https://doi.org/10.22271/allresearch.2023.v9.i6b.10931.

[26] Sarminah Samad and Waleed Abdulkafi Ahmed, "Do Strategic Planning Dimensions and Transformational Leadership Contribute to Performance? Evidence from the Banking Sector," *Management Science Letters*, 2021, 719–28, https://doi.org/10.5267/j.msl.2020.10.037.

[27] Steven McGee and Nivedita Nutakki, "The Impact of Adapting a General Professional Development Framework to the Constraints of In-Service Professional Development on the Next Generation Science Standards in Urban Settings.," *Journal of Urban Learning, Teaching, and Research* 13 (2017): 73–89.

[28] Min Tang, Ping Ren, and Zhiqiang Zhao, "Bridging the Gap: The Role of Educational Technology in Promoting Educational Equity," *The Educational Review, USA* 8, no. 8 (2024).

[29] Tang, Ren, and Zhao, "Bridging the Gap: The Role of Educational Technology in Promoting Educational Equity."

promoting balanced development, as indicated in their study.[30] Their research showed that governmental involvement and enhanced assessment systems are crucial for tackling these disparities. Transformational leadership is critical to closing the resource gap in education. Eyal and Roth discovered that how principals lead has a notable impact on teachers' drive, potentially boosting the efficient utilisation of existing resources.[31] The research conducted by Gong and Li demonstrated that transformational leadership can help reduce teacher job burnout, leading to a more efficient educational setting.[32] Transformational leaders can establish a collaborative culture by motivating and enabling teachers, leading to the optimal utilisation of scarce resources. Additionally, incorporating technology into education has become a feasible remedy for insufficient resources.

Xu, Tang, and Lin discussed how mobile learning and educational technologies can improve teaching methods in higher education, offering students better learning chances even with limited resources.[33] This is in line with the research of Guthrie et al., who emphasised the transformative possibilities of online platforms. Using technology, educational institutions can expand their reach and offer high-quality education in places with limited resources.[34] Moreover, it is crucial to strategically allocate higher education resources to meet the increasing need for education. Yan highlights the significance of combining current resources and optimising investments in higher education to address the discrepancies between demand and supply.[35] This method guarantees that educational establishments can cater to varied student populations while upholding excellent education standards. Closing the divide in educational resources requires a thorough plan involving transformative leaders, strategic distribution of resources, and the creative implementation of technology.

Inclusive Strategies for Success in Mathematics Education

In mathematics education, the primary goal is to ensure all students succeed regardless of their learning needs. Inclusive strategies like differentiated instruction, scaffolding, collaborative learning, and technology integration are crucial. Differentiated instruction adjusts content and methods for individual students, while scaffolding provides temporary support as students tackle complex problems. Collaborative learning allows students to share ideas and learn from each other, fostering a deeper understanding of concepts. Technology tools enhance learning by providing interactive ways to explore mathematics concepts and allowing for personalised learning. Creating a growth mindset environment is also essential, as well as promoting perseverance and problem-solving skills. Overall, inclusive mathematics education strategies aim to meet all learners' diverse needs, fostering engagement, understanding, and achievement. By incorporating these strategies, teachers can ensure that every student has the tools and support to succeed in mathematics. It is crucial to have inclusive strategies in mathematics education to ensure that all students can effectively understand and participate in mathematics concepts, regardless of their differences. Studies show that inclusive teaching methods improve student academic performance and promote inclusion and fairness in the classroom.

Utilising cognitively guided instruction (CGI) is a successful approach that prioritises children's comprehension of mathematical reasoning. Moscardini points out that teachers who participate in CGI improve their teaching methods to be more inclusive, leading to fair classrooms that meet the needs of all students.[36] This method is based on the beliefs of inclusive education, which supports teaching

[30] J I Hong, Jian Guang Qiu, and Junlin Zhang, "Endogenous and Countermeasure Research on the Imbalance of Compulsory Education Resources Allocation in Urban and Rural Areas of China," 2017.

[31] Ori Eyal and Guy Roth, "Principals' Leadership and Teachers' Motivation," *Journal of Educational Administration* 49, no. 3 (May 10, 2011): 256–75, https://doi.org/10.1108/09578231111129055.

[32] Zhenxing Gong and Miaomiao Li, "Relationship between Nursing Mentorship and Transformational Leadership of Mentor: A Cross-sectional Study," *Journal of Nursing Management* 30, no. 2 (March 28, 2022): 413–20, https://doi.org/10.1111/jonm.13519.

[33] Tun Xu, Ling Tang, and Xifen Lin, "The Effect of Perceived Discrimination on Social Alienation of Probationers: Evidence from China," *The Prison Journal* 103, no. 3 (June 17, 2023): 347–73, https://doi.org/10.1177/00328855231173148.

[34] John T Guthrie and Nicole M Humenick, "Motivating Students to Read: Evidence for Classroom Practices That Increase Reading Motivation and Achievement.," 2004.

[35] Yu Yan, "The Management of State Financial Resources in China's Higher Education: Enhancing Regional Equity, Efficiency, and Adequacy of Financial Provision" (Sumy State University, 2024).

[36] Lio Moscardini, "Developing Equitable Elementary Mathematics Classrooms through Teachers Learning about Children's Mathematical Thinking: Cognitively Guided Instruction as an Inclusive Pedagogy," *Teaching and Teacher Education* 43 (October 2014): 69–79, https://doi.org/10.1016/j.tate.2014.06.003.

methods that acknowledge and leverage the abilities of every student rather than just focusing on their weaknesses.

In addition, structured teaching methods have proven successful in educating students with moderate and severe developmental disabilities in mathematics. Borko, Carlson, Deutscher, Boles, Delaney, Fond and Villa demonstrated that these methods can be effectively used in everyday tasks and educational settings, which helps to foster diversity in mathematics teaching.[37] This is crucial because it guarantees that students with disabilities get the necessary support customised to their academic requirements. Incorporating explicit instruction and using multiple representations are essential interventions for helping students who struggle with mathematics. Powell et al. carried out a thorough examination that pinpointed different teaching methods, such as problem-solving guidance and mnemonics usage, that intertwine and support each other, ultimately improving the learning process for every student.[38] These techniques benefit inclusive classrooms, where various learning needs must be catered to simultaneously. Additionally, instructional professionals play a crucial role in promoting inclusive practices. Muccio et al. stress the importance of instructional professionals' beliefs and actions in early childhood inclusion, highlighting the critical need for continuous professional training to help teachers effectively use inclusive methods.[39] This supports Matthews's conclusions, who suggested that creating a feeling of belonging among students in mathematics classes is essential for encouraging inclusivity.[40] Moreover, incorporating technology can improve inclusivity in mathematics teaching. Enders and Kostewicz talked about how remote teaching methods, such as interactive video technology, can help include visual aids and manipulatives in mathematics lessons, making the subject more manageable for students with disabilities.[41] This blending of technology aids in customised teaching by enabling teachers to adjust their methods according to students' needs.

THEORETICAL FRAMEWORK

Transformative Learning Theory underpins this chapter.[42] Transformative Learning Theory (TLT) is a framework that explains how individuals change their perspectives through critical reflection and experiential learning. It is particularly relevant in adult education but has broader learning and personal development applications. Mezirow's transformative learning theory is particularly well-suited for mathematics teacher leadership when advocating for equity and excellence due to its focus on deep, critical reflection and its potential for fostering meaningful change in beliefs, attitudes, and practices. Transformative learning in mathematics education encourages teachers to examine their assumptions and biases, particularly regarding equity, critically. In sustainability and climate change, transformative social learning has emerged as a vital approach. Phương et al. highlighted that transformative social learning can foster sustainable practices by integrating instrumental, communicative, and emancipatory learning.[43] This aligns with Mezirow's emphasis on critical reflection and the importance of dialogue in facilitating transformative experiences. Systemic inequities are often perpetuated by unconscious biases, which can be challenged through vital reflection to ensure all students have access to quality mathematics education. Achieving excellence in this field requires innovative and inclusive strategies facilitated by transformative learning that enables perspective transformation.

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[37] Hilda Borko et al., "Learning to Lead: An Approach to Mathematics Teacher Leader Development," *International Journal of Science and Mathematics Education* 19, no. S1 (May 2, 2021): 121–43, https://doi.org/10.1007/s10763-021-10157-2.

[38] Sarah R Powell et al., "The Effect of Addition and Subtraction Practice within a Word–Problem Intervention on Addition and Subtraction Outcomes," *Learning Disabilities Research & Practice* 38, no. 3 (2023): 182–98.

[39] Leah S. Muccio et al., "Head Start Instructional Professionals' Inclusion Perceptions and Practices," *Topics in Early Childhood Special Education* 34, no. 1 (May 24, 2014): 40–48, https://doi.org/10.1177/0271121413502398.

[40] Jamaal Sharif Matthews, "Formative Learning Experiences of Urban Mathematics Teachers' and Their Role in Classroom Care Practices and Student Belonging," *Urban Education* 55, no. 4 (2020): 507–41.

[41] Olivia G. Enders and Douglas Kostewicz, "Secondary Teachers' Remote Instructional Practices in Mathematics for Students With Disabilities," *Journal of Special Education Technology* 38, no. 1 (March 21, 2023): 50–60, https://doi.org/10.1177/01626434211059486.

[42] Jack Mezirow, "Transformative Learning Theory," in *Contemporary Theories of Learning* (Routledge, 2018), 114–28, https://doi.org/10.4324/9781315147277-8.

[43] Le Thi Hong Phuong, Tran Duc Tuan, and Nguyen Thi Ngoc Phuc, "Transformative Social Learning for Agricultural Sustainability and Climate Change Adaptation in the Vietnam Mekong Delta," *Sustainability* 11, no. 23 (November 29, 2019): 6775, https://doi.org/10.3390/su11236775.

Furthermore, Alam discusses how transformative learning frameworks can be operationalised within educational contexts to promote responsible citizenship and sustainable development.[44] This suggests that Mezirow's theory can be effectively adapted to address pressing global challenges, such as climate change, by encouraging learners to engage with their societal roles and responsibilities critically.[45] Teacher leaders can inspire their peers to shift to student-centred, culturally responsive practices that promote high achievement for all students. Teacher leaders can advocate for equity and excellence by influencing colleagues and stakeholders through dialogue and shared understanding. TLT also intersects with social justice initiatives, particularly in educational leadership. Kose outlines the roles of transformative leaders in promoting professional development aimed at equity and social justice, emphasising that transformative learning is essential for fostering an inclusive educational environment.[46] This perspective is echoed in the work of McDowell et al., who illustrated how transformative learning can enhance multicultural competence in counselling and therapy, thereby addressing systemic inequalities.[47] These studies underscore the theory's applicability in fostering critical consciousness and social equity, aligning with Mezirow's original intent to empower individuals to challenge oppressive structures. Moreover, the significance of relationships and community in transformative learning cannot be overstated. Baumgartner's research on individuals living with HIV/AIDS revealed that relational discourse and support networks are crucial for personal empowerment and transformation.[48] This finding resonates with Mezirow's assertion that transformative learning is often facilitated through dialogue and shared experiences, reinforcing the idea that learning is inherently social. Additionally, the work of Niño et al. demonstrated how service-learning initiatives grounded in transformative learning principles can lead to significant changes in students and the communities they serve, further illustrating the communal aspect of transformative education.[49]

METHODOLOGY

Semi-structured interviews were the data collection instruments used for this inquiry. Thematic analysis was employed to extract themes from the raw data. The researchers looked for similar responses in the data and grouped them to generate themes.

Research Paradigm

An interpretive paradigm was mainly chosen for this study. An interpretive paradigm, based on qualitative approaches, formulated the basis for discussing the participants' ways to eliminate traditional approaches and move to online mathematics teaching and learning.

Research Approach

The study employed a qualitative research approach known for its versatility and ability to provide an in-depth understanding of phenomena, challenge conventional representations, and contribute to theory construction and evaluation. Unlike quantitative research, qualitative research requires a more structured, open-ended, and flexible methodological approach. For Soto-Molina, the qualitative approach is defined as a form of social interaction emphasising how people make sense of reality. It involves an iterative process that generates new significant distinctions in understanding.[50]

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[44] Ashraf Alam, "Employing Adaptive Learning and Intelligent Tutoring Robots for Virtual Classrooms and Smart Campuses: Reforming Education in the Age of Artificial Intelligence," in *Advanced Computing and Intelligent Technologies: Proceedings of ICACIT 2022* (Springer, 2022), 395–406.

[45] Mezirow, "Transformative Learning Theory."

[46] Brad W. Kose, "The Principal's Role in Professional Development for Social Justice," *Urban Education* 44, no. 6 (November 9, 2009): 628–63, https://doi.org/10.1177/0042085908322707.

[47] Teresa McDowell, Kristen Goessling, and Tatiana Melendez, "Transformative Learning through International Immersion: Building Multicultural Competence in Family Therapy and Counseling," *Journal of Marital and Family Therapy* 38, no. 2 (April 18, 2012): 365–79, https://doi.org/10.1111/j.1752-0606.2010.00209.x.

[48] Lisa M. Baumgartner, "Living and Learning with HIV/AIDS: Transformational Tales Continued," *Adult Education Quarterly* 53, no. 1 (November 1, 2002): 44–59, https://doi.org/10.1177/074171302237203.

[49] Michael Nino, Mo Cuevas, and Melody Loya, "Transformational Effects of Service-Learning in a University Developed Community-Based Agency," *Advances in Social Work* 12, no. 1 (2011): 33–48.

[50] Tim Huffman, *Qualitative Inquiry for Social Justice* (Routledge, 2023).

Research Design

For this study, the case study research design was deemed suitable for its qualitative mode of inquiry to understand mathematics teacher leadership in advocating equity and excellence. The essence of case study research lies in its ability to provide rich, contextualised insights that can bridge the gap between theory and practice.[51]

Sampling Technique

A purposeful sampling technique was employed. The data was analysed according to themes generated from the findings. Research sites for data collection were five secondary schools in the OR Tambo Coastal District in the Eastern Cape Province. Three teachers from each school were individually interviewed.

Data Collection

Semi-structured interviews were utilised as the data collection tools for this paper. Semi-structured interviews help researchers explore the phenomenon more thoroughly. This research examined participants' perspectives on mathematics teacher leadership in advocating for equity and excellence. Thematic analysis was utilised to identify themes from the unprocessed data. The researchers searched for comparable reactions within the data and clustered them to create patterns.

Ethical Considerations

This study followed the ethical clearance regulations set by Walter Sisulu University. Researchers recognise that ethical concerns hold greater significance in qualitative research since qualitative researchers involve themselves in the lives of individuals. The participants were given a thorough explanation of the goals of this study. All participants signed informed consent forms agreeing to participate in the survey. The researcher requested ethical approval from the university to conduct the study. The researcher also sought consent from appropriate authorities, including the Department of Education, principals, and teachers. Participants' identities and institutional affiliations were kept confidential, with pseudonyms utilised to safeguard their anonymity and dignity. The gathered data would only be used for research purposes and nothing else.

PRESENTATION OF FINDINGS

Teachers' Views

This section describes the responses from the participants regarding four main themes identified from data analysis. Mathematics teacher leadership advocating for equity and excellence posed several challenges, particularly in rural areas. These difficulties can be broadly categorised into mathematics teacher leaders as catalysts for transformative change, empowering mathematics teachers through professional development, enabling transformative leadership in mathematics education, tackling inadequate educational resources and inclusive strategies for success in mathematics education.

Mathematics teacher leaders as catalysts for transformative change

During interviews, participants were asked how they engage with and support other teachers in fostering mathematics teaching and learning improvement in schools. Different participants gave different responses to the question.

Participants shared similar views on how they engage with and support other teachers in fostering mathematics teaching and learning improvements in schools. A participant said,

> *"I tried to organise regular workshops and learning communities where teachers can explore effective strategies for mathematics teaching, share experiences, and learn from one another, but due to the lack of funding, we met a minimal number of times per year."* At another site, one participant said, *"We don't have regular professional development sessions or structured opportunities to support other teachers in our district, so my involvement is limited."* A

[51] Stephanie Marie Zidek, *A Case Study Design Examining New Graduate Registered Nurse Well-Being* (Indiana University-Purdue University Indianapolis, 2024).

participant in another school responded, *"Without adequate resources or funding, I find it difficult to provide meaningful support to other teachers in improving their mathematics instruction."* At a different site, one participant said, *"Many teachers in my school are set in their ways and resistant to new ideas, so it's challenging to engage them in efforts to improve mathematics instruction."* A Participant from another site responded, *"Our schools are spread out over a large area, and the lack of consistent communication or in-person meetings makes it hard to engage with other teachers."* At a different site, a participant responded: *"I haven't been given any leadership responsibilities or a platform to share ideas, so my role in supporting others is practically non-existent."* In conclusion, A participant said, *"I'm still struggling with my challenges in teaching mathematics effectively, so I don't feel equipped to support others at this point."*

Empowering mathematics teachers through professional development

The section below presents feedback from participants on empowering mathematics teachers through professional development. It outlines challenges and the necessity for specialised training and development to capacitate teachers in mathematics teaching. According to the empowerment of mathematics teachers through professional development, participants responded with the following responses.

A Participant from another site responded,

"Professional development opportunities are often inaccessible in rural areas due to budget constraints and limited funding for workshops or training programs." At a site, one participant said, *"Many professional development sessions are generic and don't address the specific challenges faced by mathematics teachers in rural settings, making them feel irrelevant or unhelpful."* The participant from a different site said, *"Teachers are already overwhelmed with their day-to-day responsibilities, and there isn't enough time allocated for meaningful professional development."* Another participant said, *"Some teachers see professional development as an administrative requirement rather than an opportunity for growth, leading to disengagement during sessions."* Another participant from the same site responded, *"After attending workshops, there's often no follow-up or support to implement the strategies learned, making it difficult to translate ideas into practice."* Another site participant said, *"Professional development offerings vary greatly in quality, and many lack skilled facilitators who understand the nuances of teaching mathematics in rural areas."* One participant said, *"Professional development sessions don't always provide opportunities for meaningful collaboration among peers, which is crucial for building a supportive community of practice."*

Enabling transformative leadership in mathematics education

When participants were asked about the challenges or barriers to enabling transformative leadership in mathematics education, these were the responses they gave the researcher; teachers provided the following responses,

"Without strong backing from school leaders or district administrators, it's nearly impossible to implement transformative changes, as there's no authority to advocate for necessary resources or professional development." A participant submitted this: "*Many teachers are hesitant to adopt new teaching methods, especially in rural areas where traditional approaches have long been the norm. This resistance can stifle innovation and slow progress."*

Another participant added,

"Transformative leadership requires resources, but chronic underfunding in rural schools makes it hard to access quality materials, technology, or external training opportunities." A participant complained, "*Teachers often lack access to ongoing, high-quality professional development tailored to rural needs, making it difficult to stay updated with innovative strategies and leadership skills."*

Another teacher from another site posed another challenge by saying,

> *"Frequent turnover and high burnout rates among teachers in rural areas disrupt continuity, making it challenging to maintain leadership momentum and build a consistent team."* It was concluded by answering,*" Rural settings often lack networking opportunities, leaving teacher leaders isolated and without a community of peers to share ideas, learn, and grow from."*

Another participant said,

> *"In some communities, there's a lack of understanding or buy-in regarding the importance of transformative change in mathematics education, leading to misaligned expectations between teachers, families, and administrators."*

Inadequate resources in education

During interviews, teachers were asked how they address the unique challenges of teaching mathematics in rural areas, such as limited resources. The following are the responses from different participants in different sites.

Another participant said,

> *"Inadequate resources lead to teacher burnout and low morale, as teachers often have to use their own money or spend extra time compensating for what is lacking in the classroom."* Another participant added, *"Without proper resources, students in rural areas struggle to access quality education, resulting in lower test scores and a widening achievement gap compared to their urban counterparts."*

A participant teacher responded,

> *"The lack of technology, such as computers and reliable internet, makes it nearly impossible for students to participate in digital learning opportunities, leaving them at a severe disadvantage."*

Another participant at a different site said,

> *"Outdated textbooks and materials fail to engage students and don't reflect current educational standards, making it harder to prepare students for modern challenges."* Another participant said, *"Without funding for teacher training, teachers lack access to the latest teaching methods, which hinders their ability to deliver effective and innovative instruction."*

At a site, one participant responded,

> *"Inadequate resources often mean special education programs are underfunded or understaffed, making it difficult to meet the needs of students with disabilities."*

A similar view is derived from another participant:

> *"Inconsistent access to resources creates inequity, where students in wealthier districts thrive while those in rural or low-income areas fall further behind."*

Inclusive strategies for success in mathematics education

In exploring inclusive practices for success in mathematics education. These responses highlight barriers that can hinder the adoption or success of inclusive strategies, drawing attention to systemic challenges and areas needing improvement.Teachers responded,

> *"Many teachers in our district resist inclusive strategies because they feel it adds unnecessary complexity to their already demanding workload."* Another participant said, *"Without proper professional development, teachers struggle to implement inclusive strategies effectively, leading to inconsistent results."*

Another participant added,

> *"In rural areas, we often lack the resources—such as manipulatives, assistive technology, or trained aides—essential for inclusive mathematics education."* A participant submitted, *"Standardised testing pressures leave little room for adapting inclusive strategies, as the focus*

tends to be on covering the curriculum rather than meeting diverse needs." Another view from another participant from the same site was that a participant teacher responded, *"Inclusion requires additional planning and collaboration time, but with packed schedules, teachers rarely have the opportunity to design or deliver truly inclusive lessons."*

The same view was held by a participant from the same site:

"There's a misconception that inclusion means 'one size fits all,' leading to ineffective practices that don't support diverse learners."

Other participants from different sites said,

"*Administrators often prioritise other initiatives, leaving teachers without the leadership or resources needed to sustain inclusive practices in mathematics education."*

DISCUSSION

Findings highlighted that insufficient funding, lack of professional development, resistance to change, and limited leadership opportunities hinder mathematics teacher leaders' ability to support their colleagues effectively. Dicdiquin et al. also emphasise the importance of effective PD programmes in overcoming challenges in mathematics teaching and building teachers' confidence and knowledge in the subject.[52] Yoon et al. argue that consistent professional development is more advantageous than occasional workshops, as it encourages a deeper understanding and implementation of teaching strategies.[53] Studies show that successful mathematics teacher leaders promote professional development in their colleagues through collaborative activities, leading to a culture of ongoing enhancement and creativity in teaching strategies.[54] Participants noted that budget constraints and limited funding restrict access to workshops and teacher training, limiting professional development opportunities.

The participants also discovered that implementing transformative changes in mathematics education within rural settings is challenging without strong support from school leaders. Findings revealed that limited financial resources in rural schools hinder access to quality materials and training opportunities, undermining transformative leadership practices. Studies by Leithwood and Sun emphasised the importance of transformational leadership in enhancing school teaching methods.[55] They claim that strong leadership is essential for improving schools' " technical core, " including teaching and learning procedures. Al-Husseini et al. agree with this viewpoint, stating that transformational leadership encourages knowledge sharing among staff members, which helps in curriculum innovation and development.[56] High turnover rates and burnout disrupt team continuity, posing challenges for sustaining leadership momentum. Building and maintaining a cohesive team in rural environments is challenging due to isolation and a lack of a supportive professional community for exchanging ideas and promoting growth.

It was found that participants in rural education settings face significant challenges due to inadequate resources. Teachers often experience burnout and low morale, as they must use personal funds or invest extra time to compensate for classroom shortages. The lack of proper resources directly impacts students, leading to lower test scores and widening achievement gaps compared to urban peers. Limited access to technology hinders digital learning for rural students. Outdated textbooks and materials fail to engage students or align with modern educational standards, while insufficient funding for teacher training inhibits innovative instructional methods. Combining technology and new teaching methods like flipped classrooms enhances mathematics teachers' ability to change classroom dynamics and improve student involvement.[57] It was highlighted that resource disparities contribute to significant

[52] Dicdiquin, Mobo, and Cutillas, "Evaluating the Effectiveness of Professional Development Programs for Junior High School Mathematics Teachers in Improving Mathematics Instruction in the K to 12 Curriculum in the Philippines."
[53] Yoon et al., "Lifelong Learning with Dynamically Expandable Networks."
[54] Rubel, "Equity-Directed Instructional Practices: Beyond the Dominant Perspective."
[55] Leithwood and Sun, "The Nature and Effects of Transformational School Leadership."
[56] Al-Husseini, El Beltagi, and Moizer, "Transformational Leadership and Innovation: The Mediating Role of Knowledge Sharing amongst Higher Education Faculty."
[57] Cevikbas and Kaiser, "Flipped Classroom as a Reform-Oriented Approach to Teaching Mathematics."

inequality, with students in wealthier districts thriving while those in rural or low-income areas fall behind. Implementing inclusive strategies in rural mathematics education faces barriers, including teacher resistance, inadequate professional development, and a lack of resources. Standardised testing pressures also hinder adaptive teaching, further complicating the situation for teachers.

Teachers highlighted several challenges hindering the implementation of inclusive mathematics education in rural settings. Findings indicated that many teachers resist inclusive strategies, viewing them as adding unnecessary complexity to their demanding workloads. The lack of professional development tailored to inclusion leaves teachers ill-prepared to apply these strategies effectively, resulting in inconsistent outcomes. Numerous mathematics teacher training programmes fail to adequately cover the challenges of equity and social justice in their courses, leaving future teachers ill-prepared to handle these critical issues in their work.[58] Additionally, it is essential to continue professional development that highlights the ethical aspects of mathematics education, motivating teacher leaders to see equity as a continuous journey rather than a fixed objective.[59] Resource limitations, such as insufficient manipulatives, assistive technologies, and trained aides, impede efforts to create inclusive classrooms. Li et al.'s research highlighted how regional economic growth influences the equitable allocation of educational resources.[60] They contended that differences in the distribution of teachers and resources in urban and rural areas negatively impact the overall education quality. Standardised testing pressures prioritise curriculum coverage over meeting the diverse needs of students, restricting opportunities for adaptive teaching. The additional planning and collaboration required for inclusive practices are often unfeasible due to packed schedules. Misconceptions, such as equating inclusion with a "one size fits all" approach, lead to ineffective practices that fail to support diverse learners. Moscardini pointed out that teachers who participate in CGI improve their teaching methods to be more inclusive, leading to fair classrooms that meet the needs of all students.[61] Furthermore, administrators frequently prioritise other initiatives, leaving teachers without the leadership, guidance, or resources necessary to sustain meaningful, inclusive practices in mathematics education.

RECOMMENDATIONS

Based on the presentation of findings and discussion, it is recommended that tackling issues like inadequate funding, absence of professional growth, reluctance to change, and limited leadership should call for specific actions like more funding, professional development initiatives, leadership opportunities, and collaboration strategies, despite geographical limitations. Collaboration between teachers is crucial for establishing a supportive community and fostering growth. It was recommended that school districts and educational institutions should introduce compulsory, continuous professional development programs designed to promote inclusive practices in math classrooms. These programs must prioritise practical, evidence-backed techniques to meet the needs of various learners and reduce the strain on teachers' workloads. Universities and teacher training institutions are to update curricula by incorporating thorough modules on inclusion, equity, and social justice within mathematics education. This should involve case studies, role-playing situations, and experience in real classroom environments to prepare future educators with the essential abilities to handle students from varied backgrounds effectively. Government and educational policymakers were advised to prioritise allocating extra funding to rural schools. Funding should focus on obtaining high-quality teaching materials, enhancing infrastructure, and offering professional development opportunities to support transformational leadership.

CONCLUSION

Mathematics teacher leadership is essential in fostering equity and excellence in education. By embracing the dual role of educator and advocate, mathematics teacher leaders are uniquely positioned

[58] Golding, "The Development of Teachers of Mathematics in Sub-Saharan Africa: Reflections on Moving Forward with Confidence."
[59] Boylan, "Deepening System Leadership."
[60] Lixu Li et al., "Digital Technology-Enabled Dynamic Capabilities and Their Impacts on Firm Performance: Evidence from the COVID-19 Pandemic," *Information & Management* 59, no. 8 (2022): 103689.
[61] Moscardini, "Developing Equitable Elementary Mathematics Classrooms through Teachers Learning about Children's Mathematical Thinking: Cognitively Guided Instruction as an Inclusive Pedagogy."

to inspire change, challenge inequities, and ensure that all students have access to high-quality mathematical learning opportunities. Leadership in mathematics extends beyond the classroom, encompassing collaboration with colleagues, informed advocacy for systemic improvements, and the development of inclusive practices that address the diverse needs of learners. As champions of equity, mathematics teacher leaders actively dismantle barriers that hinder access to rigorous and meaningful mathematical instruction. By leveraging data, research-based strategies, and culturally responsive teaching methods, they cultivate environments where every student can thrive, regardless of background or ability. Their commitment to excellence ensures that mathematics is not merely a subject but a tool for empowering students to think critically, solve problems, and navigate the complexities of the modern world. Ultimately, mathematics teacher leaders play a transformative role in shaping equitable educational systems that prioritise excellence for all. Through their advocacy, collaboration, and innovation, they illuminate the path toward a future where mathematics is a bridge to opportunity, empowering every student to achieve their full potential.

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