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FACTORS THAT LIMIT

THE CO-CREATION OF MATHEMATICS KNOWLEDGE DURING FUNCTIONS LESSONS IN RURAL SCHOOLS

FACTORES QUE LIMITAN LA CO-CREACIÓN DEL CONOCIMIENTO MATEMÁTICO DURANTE LAS CLASES DE FUNCIONES EN LAS ESCUELAS RURALES

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ABSTRACT

This study aims to explore the factors influencing instructional choices and how systemic constraints impact the ability of teachers to implement conceptual link-making strategies. The study adopts a qualitative research paradigm and employs a multiple-case study design. Data were collected from five Grade 10 mathematics teachers in rural schools in the Acornhoek region, Mpumalanga Province. Using semi-structured interviews, non-participant classroom observations, and video-stimulated recall interviews (VSRI), the study gathered insights into teachers' pedagogical practices. Thematic analysis was used to identify patterns in instructional choices and classroom discourses, ensuring data trustworthiness through triangulation, member checking, and audit trails. Findings indicate that teachers adhere strictly to curriculum pacing guides, which limits deep engagement with mathematical concepts. The pressure to achieve high pass rates fosters an assessment-driven instructional approach, while the dominance of teacher-led instruction results in minimal student participation and restricted opportunities for conceptual link-making. The study recommends greater flexibility in curriculum pacing, targeted professional development programs, and increased access to digital and interactive teaching resources to improve the quality of mathematics education in rural schools.

Keywords: Communicative approach, Functions, Pedagogical Link-Making, Rural education, Mathematics teaching.

RESUMEN

Este estudio pretende explorar los factores que influyen en las elecciones que se hacen en la instrucción y cómo las restricciones sistémicas afectan la capacidad de los profesores para implementar estrategias de vinculación conceptual. se adopta un paradigma de investigación cualitativa y emplea un diseño de estudio de casos múltiples. Se recogieron datos de cinco profesores de matemáticas de 10º grado de escuelas rurales de la región de Acornhoek, en la provincia de Mpumalanga. Mediante entrevistas semiestructuradas, observaciones no participantes en clase y entrevistas de recuerdo estimuladas por vídeo (VSRI), el estudio recabó información sobre las prácticas pedagógicas de los profesores. Se utilizó el análisis temático para identificar patrones en las decisiones de instrucción y los discursos en el aula, garantizando la fiabilidad de los datos mediante la triangulación, la comprobación de los miembros y las pistas de auditoría. Los resultados indican que los profesores se ciñen estrictamente a las guías curriculares, lo que limita la profundización en los conceptos matemáticos. La presión por conseguir un alto índice de aprobados fomenta un enfoque pedagógico basado en la evaluación, mientras que el predominio de la enseñanza dirigida por el profesor da lugar a una participación mínima de los alumnos y a oportunidades restringidas para establecer vínculos conceptuales. Para mejorar la calidad de la enseñanza de las matemáticas en las escuelas rurales, el estudio recomienda

una mayor flexibilidad en el currículum, programas de desarrollo profesional específicos y un mayor acceso a recursos didácticos digitales e interactivos.

Palabras clave: Enfoque comunicativo, Funciones, Vínculos pedagógicos, Educación rural, Enseñanza de las matemáticas.

INTRODUCTION

A significant number of teachers and learners in rural schools across South Africa remain the most vulnerable. This is due to issues associated with social injustice despite South Africa having been a democratic country for 27 years. The legacy of the apartheid education system still prevails, especially the standards of education that people in different geographic locations still receive. "In the past, the South African education system reflected the fragmented society in which it was based" (Msila, 2007, p. 146), as the racial discrimination reflected in all apartheid laws that favoured 'White', 'Asian', 'Coloured', and 'Native' respectively. Recently, Chirinda et al. (2021) have argued that South African learners still learn under unequal economic circumstances with existing differences regarding learning recourses. The authors attribute this to the apartheid education system that continues to impact the historically deprived schools. The origin of the social injustice in education was orchestrated by the then prime minister Verwoerd's statement, "What is the use of teaching the Bantu child mathematics when he cannot use it in practice?" (Hirson, 1979, p. 45). The racialisation of mathematics education during apartheid had dire "implications for teacher training in Black African schools because it perpetuated poor teaching and learning in Black African schools" (Mbhiza, 2017, pp. 3-4). The apartheid government deliberately excluded Black people from teaching and learning mathematics because it was preserved for White learners (Spaull, 2013). Mathematics was used as a tool for social and economic segregation. It resulted in a high shortage of qualified quality mathematics teachers in areas where most of the population was Black. The results of this past are noted in the continuously appalling standards of mathematics education nationally (Spaull, 2013), particularly in rural contexts.

It could be argued that Black communities were not only denied mathematics education but the future and the limited opportunities by the apartheid government. The legacy of apartheid proves difficult to dismantle in a democratic South Africa, especially for African rural teachers and learners who continue to experience a shortage of mathematics teachers with appropriate qualifications and expertise (Adler & Venkat, 2014). Similarly, the Nkambule (2017) reiterated that the biggest reason for poor learner performance is the lack of qualified teachers in rural schools, especially for mathematics. This statement does not overlook the outcry in township schools about insufficient mathematics teachers; however, rural schools continue to be appalling because of the difficulties in attracting and retaining quality teachers. Given the above discussion, it was important to explore and understand how mathematics is taught in rural secondary schools in a democratic South Africa. This is particularly important because mathematics is considered one of the school subjects that could transform and help children improve their standards of living and become effective citizens of their communities and the nation (Spaull, 2013). The focus of the current study was to understand teachers' discourses and approaches during the functions lessons because it is considered one of the important topics that facilitate learners' understanding of other topics in the mathematics school curriculum. A significant reason for this focus is the view that the functions concept is a unifying concept in mathematics.

The standard of rural education in South Africa and in many other countries such as Ghana, Uganda, China, United States of America, Mali, and Iran, to mention just a few, faces great challenges. Some of those challenges include attracting and retaining qualified quality mathematics teachers, resulting in the difficulty of offering quality standards within rural schools (Nkambule, 2017). Of interest from the above-mentioned countries is that even developed countries face similar challenges as developing countries. For example, from the United States context, Stelmach (2011, p. 36) stated that "teacher shortages are characterised by lack of teachers willing to work in rural schools, lack of highly qualified or certified teachers, and lack of teachers representing ethnic minority groups." According to Spaull (2013, p. 3), "the teaching of mathematics in South African schools is amongst the worst in the world." While Spaull was not specific about whether poor teaching competencies are prevalent in rural, farm, urban, or township schools, researchers stated that past research has shown that poor mathematics teaching has predominately been associated with rural education. To shape development in rural education globally, it is essential to explore and understand the problems associated with teaching and learning within rural contexts, as well as the assets of rural educational and social communities from different geographic locations. This paper contributes to the international debates on the conceptualisation of rurality and rural education, which are currently topical in different countries (Stelmach, 2011).

Regarding teachers' content knowledge and pedagogical approaches, Nkambule (2017, p. 192) argued that "teaching in rural settings ostensibly requires relevant knowledge and skills to cope with various eventualities and challenges, and teachers' ability to meet the challenges and responsibilities." Due to the scarcity of rural mathematics education research in South Africa, it is unclear whether teachers within rural contexts possess the 'relevant knowledge and skills' which Nkambule (2017) viewed as necessary prerequisites for effective teaching within rural classrooms. Researching with rural mathematics teachers has been consistently overlooked (Mbhiza, 2017). This study offers insights into teachers' reflections on the factors that impact their teaching of functions within rural mathematics classrooms.

The Crisis of Mathematics Education in South Africa

The standard of mathematics education in South Africa has been described as in crisis from primary to secondary schools, addressing the role of mathematics teaching, amongst other factors (Spaull, 2013). Further engagement with scholars such as Mbhiza (2017) and Nkambule (2017) provides additional insights into the complexities of rural education. These studies highlight that rural teacher often operate within constrained professional development environments, where access to subject-specific support and mentorship is limited. Studies conducted by Southern and East African Consortium for Monitoring Educational Quality (SACMEQ) and 2015 Trends in International Mathematics and Science Study (TIMSS) demonstrate that a raft of problems are present in mathematics teaching and learning in South African schools. For example, Spaull (2013, p. 4) demonstrates that in the 2007 SACMEQ results, South African learners were "ranked 10th of the 14 education systems for reading and 8th for mathematics, behind much poorer countries such as Tanzania, Kenya and Swaziland". While the tests are for the Foundation Phase, Intermediate Phase and Senior Phase, the results suggest that teachers at Grade 10 are expected to make up for the knowledge deficits, one of the reasons we decided to conduct research with Grade 10 mathematics teachers. This lower performance was also noted from the 2015 TIMSS (Spaull et al., 2022), in which South Africa came 38th and 39th for mathematics and science respectively, out of 39 countries that participated. In the 2019 TIMSS, a total of 64 countries participated in the study, and South Africa came 62nd in mathematics achievements.

Although the above studies iterated that learners' poor performance in mathematics was caused mainly by teachers' poor subject matter knowledge, it is unclear what percentage of rural teachers were part of the group (Spaull et al., 2022). This would be interesting to consider, especially when the results could be understood within the context of apartheid's well-intended disadvantaging of teachers from townships, rural and farm areas, as the past appears to be haunting mathematics performance in a democratic South Africa. To avoid sounding pessimistic, the different test results are self-explanatory for most learners, who are dominated by rural learners because South Africa is largely rural. Thus, it became imperative to explore and understand rural teachers' knowledge of functions and their approaches while teaching the topic due to the paucity of studies located in this context. To promote mathematics epistemological access in rural secondary classrooms, understanding the role of teaching as the practice of organising systematic learning is important.

Research has shown that many teachers education programs do not adequately prepare teachers for the unique challenges of teaching in rural schools (Nkambule, 2017). This can leave rural teachers feeling unprepared and unsupported, limiting their ability to engage in co-creation activities. Moreover, in-service training programs often fail to address the specific needs of rural teachers, such as the need for context-specific pedagogical strategies or the integration of local content into the curriculum. This can result in a mismatch between the training provided and the actual needs of rural teachers, further limiting the potential for co-creation.

There is increasing local and international literature on mathematics teaching and learning generally. Venkat et al. (2009, p. 11) briefly mentioned that the dearth of mathematics education research "done in rural schools is problematic given that the majority of South African learners are educated in these contexts, as urban contexts continue to be explicitly and solely focused upon." It is a crisis to lack knowledge about teaching and learning aspects, especially seeing that most of the population resides in that context. Similarly, although not focusing on mathematics teaching and learning research, Nkambule et al. (2011, p. 341) posited that "little is known of the focus of various studies and the state of rural education and rural education research in South Africa", addressing the insufficiency of research located within rural schools. Mathematics education researchers in South Africa need to expand the scope of research to include rural education if the need to redress past injustices and ensure social justice is seriously considered.

The communicative approach framework

The communicative approach framework (Scott et al., 2011) was espoused to make sense of the different teachers' pedagogical stances as they teach functions in the classroom. According to Scott et al. (2011, p. 19), the

"concept of communicative approach draws attention to the different pedagogical stances taken by the teacher as they interact with a class of students." This means that communicative approaches refer to the degree of boundary created by teachers on the pattern of interaction with their learners during teaching and learning. The nature of communication between teachers and learners during teaching and learning in the classroom has been categorised into four classes of communicative approaches: interactive/dialogic; non-interactive/dialogic; interactive/authoritative, and non-interactive/authoritative (Table 1) (Scott et al., 2011). These classes distinguish between the non-interactive and interactive patterned talk during teaching and learning.

Table 1: Four classes of communicative approaches.

COMMUNICATIVE APPROACH	DESCRIPTION
Interactive/dialogic	Both the teacher and learners collectively explore different points of view
Non-interactive/dialogic	The teacher reviews different points of view, highlighting both differences and similarities
Interactive/authoritative	The teacher is reviewing and pulling together different ideas presented by the learners to reach a particular point of view
Non-interactive/authoritative	The teacher does not allow learners to present their ideas, they present only one specific point of view

Source: Scott et al. (2011, p. 19).

Table 1 depicts the four classes of communicative approaches as interactive/dialogic; non-interactive/dialogic; interactive/authoritative, and non-interactive/authoritative. Four of the participating teachers in this study limited learners' observation, thinking, and practice of mathematical processes as a way of developing their identities as mathematics learners. Scott et al. (2011) argued that the purpose of teaching mathematics involves guiding learners to work with mathematics meanings and supporting internalisation.

MATERIALS AND METHODS

The empirical data in the current paper consists mainly of videotaped lessons presented by five mathematics teachers at five different school sites in rural Mpumalanga Province of South Africa, representing multiple cases. A qualitative research approach was espoused (Creswell et al., 2016). This approach allowed us to gain insight into rural teachers' teaching practices in their uniqueness, the nature and influence of rurality in their teaching as well as what it means for them to live and teach mathematics within a rural context and schools. To understand the teachers' lived experiences, we immersed ourselves into the lives of the teachers to explore and understand the teaching of functions as experienced by teachers.

In addition, the current study used a multiple case study design. This design enabled us to understand the nature of mathematics teaching, specifically the teaching of functions within a bounded context and bounded activity (Creswell et al., 2016). For the current study, the bounded context is mathematics classrooms in rural schools in Acornhoek, and the bounded activity is the teaching of functions at the Grade 10 level. The study was conducted with five Grade 10 mathematics teachers at five secondary schools in rural Acornhoek, Mpumalanga Province of South Africa, forming multiple cases. The schools and participating teachers were selected purposively based on their participation in the Wits Rural Teaching Experience (WRTE) project. Also, teachers needed experience and knowledge of teaching Grade 10 mathematics in rural classrooms. The study adhered to ethical principles, ensuring that participants were not subjected to any harm or coercion. These measures ensured that the research was conducted with integrity and in compliance with ethical standards. Table 2 presents participating teachers' biographical information. We use pseudonyms to conceal and protect teachers' true identities, as shown in Table 2 below. The use of pseudonyms helps in ensuring anonymity in the study.

Table 2: Teachers' biographical information.

Pseudonym	Gender	Mathematics Education qualifications	Number of years teaching	Institution trained at to become a teacher
Zelda	Female	Bachelor of Education	5 years	University of North West, South Africa
Mafada	Male	Bachelor of Education Honours	20 years	Giyani College of Education, South Africa; UNISA
Tinyiko	Female	Bachelor of Education	5 years	University of Venda, South Africa
Mutsakisi	Female	Bachelor of Education	30 years	University of Zimbabwe
Jaden	Male	Bachelor of Education	17 years	College of Education in India

Source: own elaboration.

The empirical data in the current study was generated by employing semi-structured interviews, unstructured non-participatory classroom videotaped observations, and Video-Stimulated Recall Interviews (VSRI). We used semi-structured interviews to understand Grade 10 mathematics teachers' experiences of teaching functions within rural mathematics classrooms as well as their biographical information, which offered insight into why teachers taught the topic the way they did. Classroom observations helped us gain insight into teachers' classroom performances and see what they were doing and saying during the lessons rather than what they said they were doing or their descriptions of their classroom practices during interviews. It was important for us to make sense of teachers' discourses and approaches during the lessons, and VSRI gave teachers the opportunity to reflect on their choices and usage of approaches and inhibiting certain discourses during the teaching of functions.

Data Analysis

According to Nieuwenhuis (2016, pp. 99-100), "… qualitative data analysis tends to be an ongoing and iterative process, implying that data collection, processing, analysis, and reporting are intertwined, and not necessarily a successive process." In the current study, the analysis of observed lessons commenced during the process of data collection and units of analysis were created by ascribing codes to the teachers' observed practices during teaching. After transcription, the recorded lessons were analysed to segment and distinguish the discursive activities characterising the teachers' respective discourses of functions. We first analysed each lesson for individual teachers separately, paying attention to repetitive patterns and characteristics of the teachers' discourses during the lessons. We then compared the different lessons, searching for similarities and differences and using the identified nuances to inform and reshape our analyses of the separate lessons. In the current study, we have intentionally adopted an outsider position as an attempt to view the discourses enfolding from the different teachers' teaching in as unbiased a way as possible. Equally, it is important to acknowledge that we are aware of and making use of our own mathematical knowledge, which indirectly makes us insiders to the discourse.

RESULTS- DISCUSSION

Factors That Shape Rural Teachers' Discourses and Approaches

The analysis of the VSRIs and semi-structured interviews, in relation to the observable actions during the lessons, revealed three factors that shape and reinforce teachers' teaching. The factors include 'the discourse of teaching for compliance' and 'teaching for assessment'. The factors discussed herein are the key underlying reasons shaping teachers' mathematical discourses and teaching approaches of functions, especially the adoption of non-participatory pedagogical actions during teaching.

The Discourse of Teaching for Compliance

This sub-theme addresses teachers' urgency to complete the prescribed contents within the specified times to ensure that their teaching pace is aligned with the pacesetter[1] that the district subject advisors closely monitor. From the analysis of classroom practices, the VSRI, and the semi-structured interviews, the teachers' discourses and approaches were influenced by compliance with the system, which needed teachers to complete topics within specified times.

1 The pacesetters are provided by the department and details the specific dates particular contents should be covered and examined.

Mashele (2018) reported similar findings that teachers feel like they have restricted autonomy in their classrooms as they must follow scripted lessons and must always be compliant with the policymakers' demands without questioning. This resulted in teachers rushing to complete the contents by doing all the talking, demonstrations and answering their own questions rather than encouraging learners' participation during the lessons. This further influenced the non-interactive/authoritative approach and learners' passive learning. Teaching for compliance and examination in mathematics has been mentioned in other studies (Mashele, 2018) as a key hindrance for teachers to engage learners in critical thinking about mathematical concepts to enable ownership of the skills and knowledge of functions for their understanding.

Therefore, it was problematic to observe and hear teachers mentioning the rush to complete the content coverage because learners were conditioned to rely on teachers for information. This is against the preferred post-apartheid South African learner-centred approach and curriculum goals, which advocate for imaginative, creative, and critical thinking future mathematicians. In relation to this, Julie et al. (2019) described similar teaching practices as an exercise process, which is typified by the teacher being at the centre of teaching and learning, demonstrating mathematical procedures, followed by learners practising the same procedure repeatedly with identical closed questions. From the observed lessons, teachers gravitated towards using ritual teaching because they wanted to cover the examined content, resulting in "depositing" their mathematics knowledge to the learners. There were limited opportunities to share and interchange ideas between teachers and learners to build mutual understanding and co-creation of mathematics knowledge and understanding.

The discourse of teaching for compliance was also influenced by the visits of district officials, who were also under pressure to prioritise the completion of the syllabus at the expense of learners' understanding. Thus, the teaching of functions predominantly became a practice of simple exchange of ideas to be consumed by learners in a non-participatory environment. According to Skerritt (2023, p. 1), "teachers in many schools in many education systems are now being watched in various ways and by various people", and this results in teachers teaching for compliance. We argue that learners did not participate actively in the building of mathematics knowledge and experimentation with mathematics knowledge for deep understanding and self-meaning making because of the rush to comply with the department of education officials. The teachers did not see district officials as subject advisors to assist with the improvement of content and teaching practices to improve learners' learning but as surveillance officers concerned only with enforcing content coverage compliance. While the findings suggest that teachers did not have a voice and had limited choice on how to teach functions because of the pressure, they still had "the capacity to exercise control over the nature and quality" of their teaching to ensure that learners learn and own the knowledge and skills effectively (Bandura, 1999, p. 1). The information from the VSRI demonstrates that teachers' key focus was to align their content coverage with the pacesetter to ensure that when the district advisors conduct monitoring and evaluation, they are pleased or else "***heads must roll***" (Mafada, Mutsakisi, and Jaden). The following responses illustrate the point:

I have a pacesetter; our time is too limited … I haven't finished the specified work, and our CAs (Curriculum Advisors) are coming, they are checking. I must follow the pacesetter (Jaden).

I understand that functions require much time for learners to understand, but there is not much one can do because we are rushing to finish the curriculum in time or else heads must roll. The district officials want to see proof that you have covered the topics on time as specified in the pacesetter they give us (Mutsakisi).

It is unfortunate that teachers have to develop strategies such as corrections and revisions as the quickest way to give learners answers or correct information to memorise in order to save teaching time to meet the department's expectations. There is also a feeling of disempowerment in this discourse because, to a certain extent, teachers appeared incapacitated to make thoughtful decisions about what works best for their learners since the focus was placed on meeting the pacesetter's expectations. According to Mashele (2018, p. 12), the surveillance and narrowing of the curriculum "takes away professionalisation from teachers by denying them the opportunity to apply their professional thinking capability in making pedagogical decisions in their classrooms to enhance their pedagogies." Thus, teachers' fear of falling behind schedule could be attributed to the limited opportunities they created for their learners to learn for their understanding as they developed their identity as mathematics learners.

While teachers acknowledged that functions require more time for learners to understand because of its complexity, they could not pace their lessons to support the learners' cognitive development. Teaching to meet curriculum expectations was about the production of evidence for the officials to ascertain that the prescribed contents have been covered under time constraints, especially if

the choice of words "***we are rushing***", "***see proof***", "***specified***", and "***they give us***" are considered. The issue of surveillance is also dominant in the teachers' comments about why they teach the topic the way they do. The dominance of surveillance reported by the teachers makes them to work within a constant state of inspection readiness to ensure that when the inspection occurs, they have proof that they have covered the contents. We argue that while the district officials do not necessarily dictate how teachers should teach and engage with the learners during lessons, they indirectly influence teachers' pace when teaching to ensure compliance. Even if teachers did not want to teach using the exposition technique, as demonstrated by Jaden's and Mafada's comments, teachers were still limited because, at the back of their minds, there was a need to comply due to surveillance. The way Jaden, Mafada and Mutsakisi described their experiences with the subject advisors is very much akin to the notion of power over the teachers. The emphasis seems to be on keeping the teachers from thoughtfully using pedagogical approaches and discourses they might otherwise want to use and limiting their ability to teach in ways they believe would enable their learners' deep learning and understanding, as suggested by the choice of words "***heads must roll***."

The inherent discerned "iron fist" approach used by the subject advisors grounds the teachers to use ritual routines in which learners engage in mindless mimicking, as well as teachers making generalisations for the learners. For the two teachers, giving learners time to engage in functional thinking and engage actively while teaching functions would derail the progress of content coverage, resulting in punitive measures from the subject advisor. While the teachers were not forthcoming about the nature of punishment, the district officials asserted that should they be found to be lagging with content coverage, the words "***or else heads must roll***" suggest that there are some threats that come from the officials. Undoubtedly, teachers could not focus on enabling learners' effective participation during mathematics teaching, even though some teachers tried to use dialogues, since the condition discussed herein did not promote pedagogical thinking about what works best for their classrooms or learners. The pressure from the subject advisors is concerning, considering that the specific aims of mathematics education is to produce a learner that is creative, innovative and a critical thinker.

Teaching for Assessment

The previous sub-theme focused on curriculum content coverage to ensure compliance; the current sub-theme addresses the teaching of functions to ensure that learners are familiar with steps that will enable them to answer questions that might appear in tests and examinations. Julie et al. (2019, p. 179) defined examination-driven teaching as "teaching the content of previous examinations and/or anticipated questions that might crop up in an upcoming examination of the subject." This teaching approach focuses on the mastery of procedures that are going to help learners answer examination questions correctly but does not guarantee learners' in-depth development of conceptual understanding. This was noticed in Mafada's and Jaden's reflective comments that examinations played a fundamental role in the constitution of valued and legitimate school mathematics knowledge. The teachers focused on teaching learners to follow steps that would help them to engage with and pass the tests and examinations, considering the 'politicisation' of examination results. For example, Mafada's response, "teaching learners calculation skills to answer the questions during examinations and test … making sure that they are able to answer the questions, they will always know the steps and when they pass the department is happy*"*, illustrates this pedagogical method, its difficulty and that teachers did not to think about the implications of such teaching for the learners. Julie (2013, p. 4) argued that teaching for examination "fragments knowledge, focuses on low-level content which frequently becomes the only content learners are exposed to, leads to a loss of disciplinary coherence, mitigates against flexible knowing", which means learners' coherent conceptual development is compromised.

The teachers' utterances demonstrate that the teaching is complicated by meeting performance-based teaching, as the mention of the 'exam expectations' unearths that his focus is also on examined curriculum to ensure that the 'district is off their backs'. The words "***they will always know the steps***", "***when they pass***" and not "***if they pass***" could be linked with the drilling practice that the teachers used in their lessons to ensure that learners pass. In particular, they did not allow learners to participate in learning and make mathematical meanings for themselves but solved the mathematical problems for the learners. In the above extract, Jaden and Mafada stressed the fact that the district educational authorities prioritised teachers producing high pass rates in the exam results, making teaching for memorisation relevant with the hope that some learners would develop understanding. Accordingly, the teaching was more ritualistic because of the need to meet accountability demands, which led to exam-inclined teaching approaches in the classrooms. This resonates with Julie's (2013) argument that the focus on exam-driven teaching has taken teachers' focus away from providing learners with basic knowledge of the subject matter to focusing on accountability in terms of producing good pass rates

to avoid punitive measures from the educational authorities. The fear of not meeting the pacesetter's expectations influenced the dominant use of ritual routines and did not give opportunities to demonstrate their understanding or lack thereof. Consequently, teaching focused on whether learners could engage with the procedures to answer the questions correctly and pass the examination, again with the hope of understanding. It is undeniable that one of the purposes of teaching is for the learners to pass the examinations and tests; however, encouraging learners to make meaning of the nature of functions is part of teaching.

What Mafada and Jaden talked about in the narratives is a practice that is referred to as 'curriculum narrowing' in which teachers respond to accountability pressures from educational authorities by teaching only the content that is most likely to be examined. These findings confirm Felabella's (2014) argument that the demand for accountability alters school life in complex ways that, in turn, affect the teaching profession and work ethics. In the current study, the teachers abandoned their code of ethics, which emphasises that a teacher "acknowledges the uniqueness, individuality, and specific needs of each learner, guiding and encouraging each to realise his or her potentialities" (South African Council for Educators, 2000, p. 4). Mafada's and Jaden's cases reinforce Bishop et al. (1993, p. 11) iterations that "examinations operationalise the significant components of the intended mathematics curriculum, so they tend to determine the implemented curriculum" as teachers often resort to drilling practice to make learners 'ready' for examinations. Without overlooking the teachers' reasons, their teaching was unproductive in helping learners to develop conceptual understanding. This reinforces Julie's (2013, p. 6) argument that "the intended and interpreted curricula provide only boundaries of content to be dealt with, but the implemented curriculum is heavily driven by the examined curriculum". In the current study, this resulted in the lack of teaching for deep knowledge development. Given the teachers' utterances above, the examined curriculum drives what is taught regardless of the curriculum-specific aims and skills.

According to Adler and Venkat (2014), the teaching of mathematics should draw upon rich activities, which are characterised by high intellectual demand, instead of resorting to the use of rote memorisation, so that it can inculcate learners' positive attitudes towards mathematics. Even though it could be possible that teachers' methods of teaching could be influenced by the pressure from the district officials, we argue that they could have used the activities they had designed to challenge learners' thinking and promote meaning-making. Unfortunately, due to the pacesetters from the department, teachers did not design their activities and relied on the packaged information. As we mentioned earlier, teachers are incapacitated if they are given packaged information, as this takes away their authority to practise what they have been trained to do as professionals. The Department of Education and Training in New South Wales (NSW DET, 2003, p. 10) stated that "high quality student outcomes result if learning is focused on intellectual work that is challenging, centred on significant concepts and ideas, and requires substantial cognitive and academic engagement with deep knowledge." In view of this, it is concerning that the district officials put pressure on teachers to rush through the content coverage as reported by the teachers, which constrains deep knowledge. We then argue that the politicisation of education disables learners' mathematics intellectual quality, considering Killen's (2015, p. 71) contention that "approaches to teaching that emphasise intellectual quality will not involve learners in simply memorising information and then regurgitating it in examinations."

DISCUSSION

The findings identified in the analysis of the VSRIs and semi-structured interviews reveal significant factors shaping rural mathematics teachers' discourses and pedagogical strategies, ultimately constraining their approaches primarily towards compliance with prescribed curricula and assessment standards. The discourse of 'teaching for compliance' reveals a pressing urgency to adhere to district mandates regarding curriculum pacing, which often results in a rush to cover content without fostering meaningful learner engagement. Such compliance-driven teaching practice aligns with observations in the literature, indicating that teachers often feel restricted in their autonomy, implementing scripted lessons that prioritise content completion over fostering interactive learning experiences (Mashele, 2018). As a result, pedagogical actions tend toward authoritarian dynamics in the classroom, hampering learners' active participation and critical engagement with mathematical concepts.

The subsequent finding of 'teaching for assessment' further illustrates how the pressure to ensure learners can perform well on examinations significantly influences teaching methods. Teachers express that their focus is invariably on teaching learners' procedural skills necessary for exam success. This examination-focused approach leads to what is commonly referred to as 'curriculum narrowing,' where teachers concentrate primarily on material likely to be tested, thus sacrificing a more holistic educational experience (Falabella, 2014). Consequently, the environment necessitated by compliance and assessment not only limits the pedagogical freedom of teachers but

fundamentally detracts from their capacity to cultivate learners who can think critically and creatively in mathematics. Such pressures signify a systemic issue in rural education, where fulfilling administrative expectations supersedes the educational and developmental needs of learners.

CONCLUSION

The overall findings indicate that teachers rushed the teaching of functions because of the pressure from the department of education and assessment practices. The pressure to be on par with the pacesetter resulted in teachers using the ritualistic routines discourse and non-interactive/authoritative approach because they taught for themselves and not for learners' promotion of engagement to develop their knowledge and understanding of the topic and sub-concepts. Some teachers commented that creating interactive classroom environments where there was a collective engagement between teachers and learners was a time waster and a hurdle for them because of the expectations of using and being on par with the pacesetters. Accordingly, they resorted to adopting an exposition strategy and being givers of ready-made content about the different families of functions. The teachers' focus on preparing learners for assessments resulted in under-teaching of functions. Consequently, teachers predominantly used rituals to ensure that the learners became familiar with the mathematical substitution and calculations as well as drawing graphs as part of the examinable parts of the topic. This limited the opportunities of all learners to explain the generalisations about key features of functions, which are dependent on explorations of aspects such as the effect of changing the values of parameters on the four families of functions.

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REFERENCES

Adler, J., & Venkat, H. (2014). Teachers' mathematical discourse in instruction: Focus on examples and explanations. In Exploring Mathematics and Science Teachers' Knowledge (pp. 132-146). Routledge.

Bandura, A. (1999). Social cognitive theory: An agentic perspective. ***Asian journal of social psychology,*** *2*(1), 21-41.https://onlinelibrary.wiley.com/doi/abs/10.1111/1467-839X.00024

Bishop, A. J., Hart, K., Lerman, S., & Nunes, T. (1993). Significant influences on children's learning of mathematics.

Chirinda, B., Ndlovu, M., & Spangenberg, E. (2021). Teaching mathematics during the COVID-19 lockdown in a context of historical disadvantage. ***Education Sciences, 11***(4), 177. https://www.mdpi.com/2227-7102/11/4/177

Creswell, J. W., & Poth, C. N. (2016). Qualitative inquiry and research design: Choosing among five approaches. Sage publications.

Falabella, A. (2014). The performing school: The effects of market and accountability policies. ***Education policy analysis archives***, 22, 70-70. http://epaa.asu.edu/index.php/epaa/article/view/1315

Hirson, B. (1979). Year of fire year of ash: The Soweto revolt: Roots of a revolution. https://repository.hsrc.ac.za/handle/20.500.11910/9772

Julie, C. (2013). Can examination-driven teaching contribute towards meaningful teaching?. In ***Proceedings of the ISTE International Conference on Mathematics, Science and Technology Education*** (pp. 1-14). Pretoria: UNISA Press.

Julie, C., Mhakure, D., & Okitowamba, O. (2019). Examination-driven teaching as an underpinning of Ledimtali. ***Caught in the act: Reflecfions on confinuing professional development of mathemafics teachers in a collaborafive partnership***, 162-187.

Killen, R. (2015). ***Teaching strategies for quality teaching and learning***. Juta and Company Ltd.

Mashele, S. F. (2018). ***The impact of curriculum changes on the working lives of rural teachers***. University of Pretoria (South Africa).

Mbhiza, H. W. (2017). ***A critical exploring of grade 10 rural learners' experiences and attitudes towards learning mathematics in Acorhoek classrooms, Mpumalanga province*** (Doctoral dissertation). https://wiredspace.wits.ac.za/items/ef8c74ce-733e-4b34-9cbb-bfee0565c85e

Msila, V. (2007). From apartheid education to the Revised National Curriculum Statement: Pedagogy for identity formation and nation building in South Africa. ***Nordic Journal of African Studies***, ***16***(2). https://www.njas.fi/njas/article/view/63

Nieuwenhuis, J. (2016). Qualitative research designs and data-gathering techniques. In K. Maree (Ed.), First Steps in Research (2nd ed., pp. 72-103). Van Schaik Publishers.

Nkambule, T., Balfour, R. J., Pillay, G., & Moletsane, R. (2011). Rurality and rural education: Discourses underpinning rurality and rural education research in South African postgraduate education research 1994-2004. ***South African Journal of Higher Education***, ***25***(2), 341-357. https://journals.co.za/doi/abs/10.10520/EJC37678

Nkambule, T. C. (2017). Student teachers' perceptions of a Wits rural teaching experience project: What to learn and improve. ***South African Journal of Higher Education***, ***31***(1), 191-206. https://www.journals.ac.za/sajhe/article/view/901

NSW Department of Education and Training 2003. ***Quality Teaching in NSW Public Schools*** (Discussion paper)***.*** Sydney: NSW DET, Professional support and curriculum directorate.

South African Council for Educators, 2000. ***Handbook for the Code of Conduct of Professional Ethics.*** Centurion: Author.

Scott, P., Mortimer, E., & Ametller, J. (2011). Pedagogical link-making: a fundamental aspect of teaching and learning scientific conceptual knowledge. ***Studies in Science education***, ***47***(1), 3-36. https://www.tandfonline.com/doi/abs/10.1080/03057267.2011.549619

Skerritt, C. (2023). School autonomy and the surveillance of teachers. ***International Journal of Leadership in Education***, ***26***(4), 553-580. https://www.tandfonline.com/doi/abs/10.1080/13603124.2020.1823486

Spaull, N. (2013). Poverty & privilege: Primary school inequality in South Africa. ***International journal of educational development***, ***33***(5), 436-447. https://www.sciencedirect.com/science/article/pii/S0738059312001381

Spaull, N., Courtney, P. E. T. E. R., & Qvist, J. E. S. S. (2022). Mathematical stunting in South Africa: An analysis of Grade 5 mathematics outcomes in TIMSS 2015 and 2019. ***Early grade mathematics in South Africa, 15.***

Stelmach, B. L. (2011). A synthesis of international rural education issues and responses. ***Rural Educator***, ***32***(2), 32-42. https://eric.ed.gov/?id=EJ987606

Venkat, H., Adler, J., Rollnick, M., Setati, M., & Vhurumuku, E. (2009). Mathematics and science education research, policy and practice in South Africa: What are the relationships? ***African Journal of Research in Mathematics, Science and Technology Education***, ***13***(sup1), 5-27. https://www.tandfonline.com/doi/abs/10.1080/10288457.2009.10740659