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Research Article

Systemic challenges affecting teachers' instruction of mathematics in the early grades

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Abstract

This study was prompted by the persistently low mathematics performance of the Foundation Phase (Grades 1-3) in South African public primary schools, as reflected in both national and international assessment outcomes. The Department of Basic Education has noted that most learners in the Foundation Phase underperform significantly in systemic evaluations. Local research attributes this poor performance to a range of systemic challenges, including barriers related to curriculum implementation, inadequate departmental support, and deficits in teacher knowledge. In particular, many teachers lack both mathematical content knowledge and pedagogical content knowledge, which further hampers effective mathematics instruction. This study aimed to explore the systemic challenges faced by Foundation Phase teachers in teaching mathematics in the early grades and to identify strategies that could support their instructional practices. The research was guided by the Care and Support for Teaching and Learning (CSTL) Framework, which emphasises the need for all schools to be adequately supported in promoting numeracy development in the Foundation Phase. A qualitative case study design, situated within an interpretivist paradigm, was employed, utilising six Foundation Phase teachers from three schools in Gauteng Province who were purposively selected to participate in the study. Data were generated through interviews and thematic analysis. Findings revealed that all participating teachers experienced significant challenges due to limited access to teaching resources, large class sizes, language barriers, insufficient professional development opportunities, and a lack of systemic instructional support from curriculum advisors. Most teachers reported receiving minimal training in how to effectively teach mathematical concepts in large multilingual classes with limited resources. The study recommends that the Department of Education revisit its teacher-learner ratio policy and its policy on Care and Support for Teaching and Learning, ensuring that curriculum advisors provide ongoing support to teachers.

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Introduction

Poor learner mathematics performance, highlighted by high failure rates, has surfaced as a salient challenge in South Africa (Fleisch, 2008). Mathematics achievement is a key educational outcome in most countries. Competency in mathematics is critical to the world of work in fields such as science, technology, engineering and mathematics. Most South African learners are not performing as expected in national and international assessments. In the Annual National

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Assessment (ANA) and the Trends in International Mathematics and Science Study (TIMSS), the Department of Basic Education (DBE) (2010) found that most learners faced challenges in answering questions related to basic number sense. Analysis of the ANA and TIMSS results revealed that learners lacked basic numeracy skills, particularly in understanding and applying number sense (computation, place value, and number names) (DBE, 2011a). A comparative study by Carnoy and Chisholm (2008) reveals that the low performance of Foundation Phase learners in mathematics is reflected in the performance of their teachers. This is also evident in the data from the SACMEQ III study (Moloi & Chetty, 2010).

According to Courtney-Clarke and Wessels (2014), learner performance is directly linked to teachers' subject knowledge, and their confidence influences how they teach. Despite the confidence and motivation teachers may have for teaching mathematics, they often face systemic challenges and barriers that make it difficult for them to teach effectively. The purpose of this paper was to explore the systemic challenges experienced by teachers in teaching mathematics in the Foundation Phase. The main research question that guides the study was: 'What are the challenges Foundation Phase teachers experience in teaching mathematics, and what strategies need to be implemented to support teachers?

Literature Review

Importance of mathematics in the early grades

Early-grade mathematics education plays a significant role in shaping learners' cognitive development and academic success. It provides essential building blocks for understanding number sense, spatial reasoning, patterns, measurement, and basic operations—skills that underpin more complex mathematical thinking in later grades (Department of Basic Education [DBE], 2021). The New Zealand Government (2016) states that a child's formative experience with mathematics lays the groundwork for their future mathematics learning and success. Mathematical knowledge and skills enable learners to think logically, strategically, creatively and critically. Spaull and Winnaar (2022) argue that strong numeracy skills in the early years have been linked to improved performance not only in mathematics but across multiple learning areas, including literacy and science. According to Clements et al. (2021), early mathematical proficiency significantly enhances children's problem-solving skills and logical reasoning, laying the groundwork for lifelong learning. Research by Kotze and Letswalo (2023) highlights that learners who develop conceptual understanding in the Foundation Phase are better positioned to engage meaningfully with mathematics in the Intermediate Phase and beyond.

Furthermore, high-quality early mathematics education is essential for promoting equity and closing persistent achievement gaps in South African schools. Learners from disadvantaged backgrounds often enter the education system with limited exposure to foundational mathematical concepts, making targeted early intervention vital (Van der Berg & Gustafsson, 2021). Without adequate support in the early years, these learners are at risk of falling further behind, contributing to the cycle of underachievement in later grades (Moloi, 2022). To address this, Foundation Phase teachers must be equipped with strong content and pedagogical knowledge, as well as access to appropriate teaching resources and professional development opportunities (Ramdhani & Mkhize, 2023). As noted in the DBE's Care and Support for Teaching and Learning (CSTL) framework, strengthening early mathematics instruction is a national imperative to ensure long-term learner success (DBE, 2008).

Role of the teacher in teaching mathematics

The role of the teacher in mathematics education is pivotal to learners' conceptual understanding and long-term success in the subject. Teachers should present mathematical concepts, methods, and language with enthusiasm, using diverse, research-based pedagogical approaches that encourage curiosity and engagement (Jacobs, Martin & Otieno, 2020). Effective mathematics teachers create learning experiences that allow learners to explore, connect, and apply mathematical ideas across the curriculum, reinforcing the integration of numeracy in everyday learning (Spaull & Winnaar, 2022). According to Essien and Setati-Phakeng (2021), teachers play a key role in facilitating meaningful mathematical dialogue, enabling learners to construct their understanding through guided discovery and peer interaction.

Teachers need to foster a classroom environment where learners are encouraged to share their thinking, justify their reasoning, and collaborate on problem-solving tasks (Venkat & Askew, 2018). Motivation is a critical component of early mathematics learning, and teachers must inspire learners through engaging, culturally responsive pedagogies that build confidence and positive attitudes toward mathematics (Pather, 2020). Inappropriate teaching practices, such as rote memorisation, when disconnected from conceptual understanding, can hinder learners' mathematical development and promote anxiety (Phiri, 2021). Well-prepared teachers with strong mathematical content and pedagogical knowledge tend to employ a variety of instructional strategies, including the use of manipulatives, visual representations, and open-ended questioning, to promote deeper learning (Mkhwanazi & Luneta, 2021). In contrast, teachers with limited content knowledge often rely on textbooks, avoid learner interaction, and focus on procedural teaching, which limits learners' opportunities for critical thinking and reasoning (Sibanda & Graven, 2019). Therefore, ongoing professional development and support are essential to empower teachers to become confident, reflective practitioners who can effectively facilitate mathematics learning in the Foundation Phase.

Systemic barriers affecting the teaching of mathematics

Systemic barriers continue to impede the effective teaching of mathematics in the early grades in South Africa, resulting in persistent underperformance and widening learning gaps. One of the most pressing issues is the misalignment and inappropriateness of curriculum content, which often fails to reflect learners' developmental stages and socio-cultural contexts (Bansilal, 2017). The curriculum is frequently overloaded with abstract concepts introduced too early without building a solid foundation of number sense and reasoning, which compromises conceptual understanding in the Foundation Phase (Venkat & Askew, 2018). Large class sizes further exacerbate these challenges, making it difficult for teachers to offer individualised attention or implement learner-centred pedagogies. In overcrowded classrooms, teachers struggle to manage time and maintain effective classroom engagement, which limits opportunities for formative assessment and differentiated instruction (Spaull, 2015). Language barriers also significantly hinder mathematics learning, particularly in multilingual classrooms where learners are taught in a language that is neither their native language nor one they understand adequately. Many young learners encounter mathematical concepts for the first time in English, which increases cognitive load and impedes comprehension (Setati & Moschkovich, 2017).

In addition to these learner-level challenges, the lack of appropriate teaching resources—such as manipulatives, visual aids, and bilingual materials—undermines effective mathematics instruction (Mkhwanazi & Luneta, 2021). Teachers in under-resourced schools often rely on rote methods and textbook-driven approaches due to the limited availability of teaching aids, which restricts active learning and problem-solving opportunities. Furthermore, curriculum specialists and subject advisors often lack adequate support or training, which restricts their ability to provide meaningful pedagogical guidance to teachers (Phiri, 2020). Although policies such as the National Policy on Curriculum and Assessment (2011**)** aim to promote inclusive and effective mathematics education, implementation remains inconsistent and poorly **monitored**, particularly in rural and under-resourced contexts (DBE, 2020; Mouton, Louw & Strydom, 2015). These systemic failures collectively reinforce educational inequalities, and unless addressed through targeted reforms, they will continue to compromise the quality of mathematics education in the early grades.

Theoretical framework

The Care and Support for Teaching and Learning (CSTL) framework, developed by South Africa's Department of Basic Education (DBE, 2008), is a comprehensive policy initiative designed to create enabling conditions for quality teaching and learning, particularly in under-resourced and high-need schools. It emphasises a whole-school approach, aiming to integrate care, support, and collaboration into everyday teaching environments to enhance learner success and teacher wellbeing (DBE, 2021). In theory, CSTL is well-positioned to address systemic barriers that impede effective mathematics instruction in the early grades—such as inappropriate curriculum content, overcrowded classrooms, insufficient teaching resources, and inadequate teacher support (Van der Berg & Gustafsson, 2021). However, despite its policy promise, implementation challenges persist, with many schools lacking the infrastructure and capacity to translate CSTL into meaningful action (Spaull & Winnaar, 2022).

Early-grade mathematics teachers face a complex set of challenges that extend beyond classroom instruction. The curriculum is often overloaded with abstract concepts that are developmentally inappropriate for young learners, undermining deep conceptual understanding and progression (Venkat & Askew, 2018). Moreover, large class sizes remain a critical issue, especially in rural and township schools, where teachers are unable to provide individualised support, thus limiting opportunities for learner engagement and formative assessment (Hoadley, 2018). Language barriers further complicate the teaching of mathematics, as many Foundation Phase learners receive instruction in a language they have not yet fully mastered, which significantly impedes their comprehension and achievement in numeracy (Brodie, 2021).

The CSTL framework advocates for the provision of resources and professional development. However, studies reveal that teachers continue to operate with limited access to manipulatives, bilingual materials, and instructional aids necessary for effective mathematics teaching (Mkhwanazi & Luneta, 2021). Compounding this, curriculum specialists and subject advisors are often overstretched, undertrained, or inconsistently deployed, which limits the pedagogical guidance that teachers need to improve their practice (Phiri, 2020). While CSTL highlights the need for supportive structures such as school-based support teams (SBSTs) and professional learning communities (PLCs), these mechanisms are often underutilised due to lack of training, monitoring, and integration into school development plans (Ngcobo & Mthiyane, 2019).

Moreover, policy coherence and accountability remain weak, with schools and districts often failing to implement CSTL strategies consistently, especially in contexts of poverty and systemic inequality (Zuze & Beku, 2022). Without clear accountability systems and adequate resourcing, CSTL risks being reduced to a well-intentioned but under-implemented initiative. Suppose the Department of Basic Education is to realise the framework's potential. In that case, it must prioritise the development of teacher capacity in mathematics, increase the availability of teaching resources, strengthen instructional leadership, and provide dedicated support for early-grade numeracy (Ramdhani & Mkhize, 2023).

In conclusion, while the CSTL framework offers a promising response to the systemic challenges facing mathematics teachers in the early grades, its success depends heavily on practical implementation, targeted investment, and rigorous monitoring and evaluation. Without these, foundational mathematics education in South Africa will continue to suffer, reinforcing educational inequalities that CSTL was designed to dismantle.

Method

The researcher employed a qualitative research approach to explore the systemic challenges experienced by Foundation Phase teachers in teaching mathematics in the early grades. Qualitative research is appropriate for understanding lived experiences and interpreting social phenomena from the participants' perspectives (Mogashoa, 2014). This approach enabled the researcher to gain in-depth insights into teachers' day-to-day realities, their professional challenges, and their perspectives on the systemic barriers that affect effective mathematics instruction.

A purposive sampling method was employed to ensure that participants met specific inclusion criteria, namely that they were Foundation Phase teachers with a minimum of five years of teaching experience. Six teachers participated in the study—two each from Grades 1, 2, and 3—drawn from three public primary schools in Gauteng Province. To ensure confidentiality and anonymity, pseudonyms were used during the reporting phase. For this study, the codes T1, T2, T3, T4, T5 and T6 were used for each participant. T1 and T2 were from Grade 1, T3 and T4 from Grade 2, and T5 and T6 were from Grade 3.

Data collection methods included a semi-structured focus group interview, classroom observations, document analysis (such as lesson plans and assessment tools), and teacher reflective journals. These strategies were selected to generate rich, triangulated data on how teachers navigate issues such as curriculum overload, resource shortages, large class sizes, and language barriers in mathematics teaching.

The data were analysed following the five-step process outlined by Creswell (2016): reading through all the data, dividing the text into meaningful segments, assigning codes, reducing code redundancy, and collapsing codes into

overarching themes**.** The trustworthiness of the data was established through triangulation**,** comparing data across multiple sources to identify recurring patterns and confirm consistency.

Ethical clearance was obtained from the university's ethics committee, and informed consent was secured from all participants. The study adhered to ethical research principles by ensuring confidentiality, anonymity, and respect for participants' privacy throughout the research process.

Findings and Discussion

The data was analysed thematically using Creswell's six steps in data analysis. Three major themes were identified from the analysis. They were; Systemic barriers affecting mathematics teaching in the early grades, Teacher knowledge and professional development gaps, Policy and support framework.

Theme 1: Systemic barriers affecting mathematics teaching in the early grades

This theme explored the various systemic barriers and challenges that teachers face in teaching mathematics during the foundation phase of education. The purpose was to capture the contextual and structural factors that hindered effective mathematics teaching and learning. For this reason, during the interview, participants were asked to share their experiences regarding the systemic barriers that influenced their mathematics teaching practices.

All participants (T1, T2, T3, T4, T5, and T6) agreed that they experienced various barriers to teaching mathematics.

> They mentioned that they were faced with minimal resources in their class, large class sizes, language barriers, inadequate support from curriculum advisors, and a lack of policy knowledge, as well as content and pedagogical content knowledge.

T1 mentioned that she teaches Grade 1 and she has a class size of 45 learners. She stated that it was challenging for her to teach such a large class due to its multilingual nature. "*I find it very difficult to teach learners in my class. There is a language barrier, and this makes understanding mathematics very difficult*." Similarly, T2 also experienced language barriers in her class and also found it a challenge. Nkoy, Venketsamy and Sing (2022) state that most South African classrooms are multilingual, and learners come from diverse cultural backgrounds, thus making teaching and learning a challenge. She mentioned, "*In my class, there are six to eight different languages spoken. These children don't know a word of English. I have to try different ways to teach them mathematics. I am glad that mathematics language is symbols rather than words.*" DBE (2011) concurs that mathematics has its language and is primarily composed of symbols.

Despite the large classes and overcrowding, T3 and T4 mentioned that they are challenged with inappropriate support from the curriculum advisor and subject specialist. They mentioned that the curriculum had undergone a transformation since 1994, and they received very little support on how to implement the curriculum effectively in the Foundation Phase. Bansilal (2017) and Jansen (2024) agree that the South African curriculum has been through several changes and streamlining since 1994, from Curriculum 2005 (Outcomes Based Education) to the Revised National Curriculum Statement (RNCS) (2003) to the National Curriculum Statement (NCS)(2008) and finally to the Curriculum and Assessment Policy Statements (CAPS) (2011). Despite the strengthening and streamlining of the curriculum, implementing it remains a significant challenge at the school level. Shushu (2023) agrees that most teachers and subject advisors are still unfamiliar with the mathematics curriculum, which makes it challenging to support them. Ntlhare and Veliswa (2024) found that many subject advisors lack sound knowledge and understanding of the content and pedagogical content knowledge, thereby not providing teachers with adequate support. T4 expressed her view by saying, "*My subject advisor comes to my school and photocopies my file and shares this information at workshops and with other schools*."

The lack of teaching and learning resources further compounded the lack of support from subject advisors and curriculum specialists. Since resources play an integral part in teaching and learning, they are essential for both teachers and learners. Both T5 and T6 pointed out that

> *in their classes, there is a significant shortage of teaching and learning resources. In the Foundation Phase, young learners still operate on a concrete level, and there, they require physical resources and*

> *manipulatives for mathematics learning. They both indicated that they had not received sufficient materials, although the DBE has promised to send them a 'mathematics kit'.*

Additionally, T6 expressed

> *I am dissatisfied with the department's funding model. Schools are categorised into quintiles, where quintile 1 is the poorest and quintile 5 comprises schools that can manage without government funding. Furthermore, my school accommodates most learners from the nearby township and informal settlements. The parents from these communities are unable to pay school fees, yet the school is categorised as quintile 4, which means that, as a school, it is financially capable of managing itself.*

To add to the lack of resources, T1 and T3 also mentioned that they do not have the necessary manipulatives to teach mathematics in their grades. T1 mentioned, "*In grade 1, young learners want to use counters, abacus, sting of beads, sticks and other concrete materials. These are not available in my school due to the lack of funding*."

All participants in this study expressed their frustration with teaching mathematics effectively. They believe that the poor mathematics results are primarily due to the department's inability to provide schools with the necessary support. This statement concurs with Venketsamy (2024), who also found that a lack of support has an impact on effective mathematics teaching. The authors believe that language barriers, categorisation of schools, poor infrastructure and resources, and ineffective support from curriculum specialists intensify the situation, thus exacerbating the issue.

Theme 2: Teacher knowledge and professional development gaps

This theme focused on the deficiencies in the content knowledge (CK) and pedagogical content knowledge (PCK) of Foundation Phase teachers, as well as the insufficient professional development opportunities. As a result of the lack of professional development opportunities, this phenomenon limits teachers' ability to teach mathematics effectively in diverse, multilingual, and resource-constrained classrooms. During the interview, the interviewer asked the participants to share their opinions about their CK and PCK. The participants shared the following sentiments:

T1, "The curriculum has changed so many times that I have no idea how to teach some of the mathematics content. It is very challenging for me to adapt to the different methods and approaches advocated in the policy."

T3, "I did not receive any training on CK and PCK. The subject advisors come to the workshops and present slides that are meaningless to me. They do not allow us to engage with the mathematics content, design our lessons and teach the lessons to each other."

T6 stated,

> There is no emphasis on CK and PCK during the workshops or capacity-building sessions. The subject advisors read from the slides or refer us to the CAPS documents. We are told to do 'things' in mathematics rather than allowing us to interpret the curriculum, and they (subject advisors) guide us in the interpretation. Furthermore, the workshops are held infrequently, which is a significant drawback. We need workshops on an ongoing basis.

To add to this, T2 mentioned that she, along with other teachers in the area, started a community of practice where they gather to plan lessons for their respective grades. This provides them with an opportunity to learn from one another.

Theme 3: Policy and Support Frameworks

This theme examined the role of existing policies, such as the CSTL, Curriculum and Assessment Policy Statement, and White Paper 6: Inclusive Education Policy, and how these policies impact mathematics teachers in the Foundation Phase. The interviewer asked the participants to share their experiences regarding the departmental policies and their impact on their work in the classroom. All participants agreed that they were aware of these policies and heard their names during the workshops they attended. However, T1, T2 and T4 mentioned that they do not have copies of these policies in their subject files. These policies are kept in the principal's office, and only an appointment with the school secretary is allowed to read the policy and return immediately. According to the Department of Basic Education, every teacher is required to have a copy of the relevant policies in their files for easy reference.

T3 stated that she was aware of the CSTL policy, which focuses on ensuring that teachers have the necessary support, resources, and infrastructure to facilitate effective teaching and learning. However, at her school, there is still a shortage of resources and a lack of appropriate support from her subject head and the subject advisor.
T4 expressed her opinion on White Paper 6, Inclusive Education Policy. She pointed out

> This policy aims to accommodate all learners in the mainstream classroom and clearly states that every learner must be given an opportunity for success. Although this policy is good in its written form, practically, it is impossible to work with learners with language barriers and other challenges such as ADHD, Autism Spectrum Disorder and emotional barriers. In my class, there are 48 learners with different barriers, and it is so challenging to teach all of them.

All participants agreed that the curriculum transformation from 1994 to date is one of their biggest challenges. T1 said, "*Just when I am getting used to the curriculum and how to implement it, the DBE brings about a change. I have to start all over again.*" T2, "*The administrative work is more demanding than the actual teaching – I find myself doing more admin rather than focus on my teaching and learning.*" T3 and T4 agreed that the CAPS documents clearly outline what they have to teach within a term; the challenge is that there is no time for revision. The curriculum is very tightly packed, and we have to teach, assess and move on without doing mediation or remediation. According to T5 and T6, they concurred that White Paper 6 allows teachers to adapt the curriculum to accommodate all learners; however, when the subject advisors visit, they want to know why learners are lagging behind and that the curriculum pace-setters are not being applied in their schools.

Policy implementation is a significant issue in South African schools. Barry and Ginsberg (1990) state that teachers have many policies to contend with. However, these policies are good on paper, and at the implementation level, they are challenging. Chuene and Teane (2024) state that many teachers are not trained or workshopped on the policies that are sent to their schools. They have to read and make meaning of it themselves. Teachers reported a lack of meaningful engagement with curriculum advisors and insufficient systemic instructional support, indicating gaps in policy implementation (DBE, 2021)

Conclusion

This study highlighted several systemic barriers that seriously undermine the quality of mathematics teaching in the Foundation Phase. Teachers are experiencing numerous resource challenges and language barriers, which make conceptual understanding very difficult in their overcrowded classes. As a result, teachers are unable to provide learners with individual attention or address their challenges to support their learning (Spaull, 2015). The system challenges pose a significant obstacle to improving the literacy rate among learners; according to Van der Berg and Gustafsson (2021), system inefficiencies and infrastructural deficits impact foundational numeracy learning. Another critical factor that impacts learner performance is the lack of adequate teacher knowledge and pedagogical approaches. This study found that many teachers received minimal training on how to teach mathematical concepts, especially in multilingual classes effectively. The lack of ongoing professional support prevents teachers from adapting their practices to meet learners' needs and integrating innovative methodologies, such as manipulatives or formative assessments. The study found that teachers lacked meaningful engagement with curriculum advisors and insufficient systemic instructional support, indicating gaps in the implementation of policy. For CSTL and other policies to translate into improved teaching and learning outcomes, there must be stronger mechanisms for accountability, resource provision, and professional support.

Recommendations

Based on the findings in this study, the authors recommend that there should be enhanced teacher training and professional development programmes to strengthen teacher's content and pedagogical knowledge skills. Additionally, the DBE should improve resource provision and infrastructure, including manipulatives and classroom materials, to create a conducive learning environment that fosters an interest in mathematics. Furthermore, the departments must

strengthen systemic support and accountability mechanisms to ensure meaningful engagement between teachers and curriculum advisors for instructional guidance and support. To provide individualised support, there must be an effort to reduce overcrowding in the early grades, allowing teachers to identify barriers to learning and provide targeted support.

Limitations

This study was limited to only one district in the entire Gauteng province, therefore the findings may yield different results if this study was conducted across the province. Despite, this limitation, the authors believe that the findings and recommendations can be generalised across the province, since the national and international results revealed that South African learners attained the lowest results in these assessments. Furthermore, the sample size is limiting in this study and the authors propose that further studies should include a large sample size and should include learners in both phases, Foundation and Intermediate.

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