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Exploring Grade 9 Teachers' Experience in Mathematics Learning Environments: A Case Study in Buffalo City Metropolitan

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ABSTRACT

Teachers' experiences in mathematics learning environments are shaped by a variety of factors, including teaching methods, learning materials, classroom culture, technological tools, and individual attitudes toward mathematics. This paper explored the Grade 9 teachers' experience in mathematics learning environments in selected schools in South Africa. The study employed a transformative paradigm of qualitative research using a phenomenological case study design. Twelve teachers were purposively selected, and the data was analysed using a thematic approach. The findings revealed, among others, that adequate resources, dynamic and innovative teaching, and learner engagement are some of the key variables that influence academic performance in mathematics. Factors like attitudes of teachers and learners towards mathematics, language in the classroom, availability of mathematical teaching aids, and socio-economic state of the family surrounding the learners to mention a few can affect the learning of mathematics. The study concludes that the key to enhancing teachers' experiences often lies in creating a balanced and supportive atmosphere where learners feel empowered to explore mathematical ideas at their own pace and with confidence. It is recommended that the education stakeholders provide a supportive classroom atmosphere, collaborative learning, teacher support, and interaction.

Keywords: *Teachers' Experience, Mathematics, Learning Environment, Classroom Atmosphere, Collaborative Learning.*

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INTRODUCTION

Education is aimed at the acquisition of skills and sophisticated competencies that determine the overall capacity of individuals to participate efficiently in economic and social life. However, there has been growing concern and debate among educators, policy-makers, and employers on the effectiveness of the current South African education curriculum in equipping learners with the expected skill set needed to meet the prevailing socio-economic challenges of the day. Upper-grade schoolers, being from the Generation Y cohort, have been referred to as better-educated, technology-savvy, impatient, sophisticated, uninterested with sign-up fee (and better-grader) contracts, risk-averse and more conscious of the development impact of their engagements.[1]

Right from the primary school level, Mathematics, and Science are taught as core subjects, imposing on learners a prolonged regime of drills and repetitive tasks that have dampened the spirit of

[1] Kemi Olajumoke Adu and Ntombozuko Duku, "Learning Styles and Instructional Materials as Correlates of Grade 6 Learners' Mathematics Performance in Buffalo City, South Africa.," *Research in Social Sciences and Technology* 6, no. 3 (2021): 242–55.

inquiry, creativity, and innovation. As a result, the products of the education system in Africa have necessarily found difficulty adapting to a rapidly changing socio-economic environment. This challenge continues to foster inequality between African countries and other nations, especially in terms of access to quality basic education, which is regarded as a fundamental Human Right. On this premise, several critically important questions arise warranting investigation. Prominent among such questions is: "How successful has education been in developing the types of literacy, numeracy, and other skills and competencies stakeholders consider necessary?" Another would be "How effectively have all nations performed along the Education Provision and Management chain?" with the anticipated output being a diagnostic tool to be used by national, state, and regional groupings for comparative purposes.[2]

There is significant concern both locally and internationally regarding some teachers' experiences and performance in mathematics. This concern arises against the backdrop of external pressures resulting from globalisation and the knowledge economy, which necessitate an abundance of skilled and knowledgeable workers to propel economic growth. Such pressing needs compel the harnessing of the talents and skills of all learners in an education system.[3] However, the South African education system is wrought with many inequalities and difficulties, which owes much to its apartheid past. Of particular concern is the necessity for low socio-economic status (SES) to achieve good mathematics learning experiences and performance, as they are the casualties of apartheid legislation in South Africa.[4]

The problem of poor mathematics performance among learners in South African public schools predominantly located in the low SES home environment has been consistently evidenced contextually and internationally.[5]

Mathematics plays a crucial role in the lives of the young people. It has been regarded as one of the important prerequisites for self-reliance in most developing countries, including South Africa.[6] Like any discipline, mathematics provides students with specific knowledge, skills, and reasoning abilities. Most importantly, mathematics can be regarded as a gate to the future. This is because as one progresses through life, participation in economic and social activities becomes subject to mathematics education.[7] However, a high proportion of mathematics learners (both in rural and urban schools) do not like mathematics.

Understanding mathematics at early levels of schooling enhances successful transition to higher levels of learning. Learners are expected to do arithmetic calculations in the local language, apply mathematical concepts in everyday situations and work with symbols, equations and functions in the secondary level of schooling. Successful transition of all these mathematical knowledge and skills depends on the learning environment within which they are taught. According to Piaget, mathematics is a human construct (the conceptualisation of the natural phenomenon by the human mind) and is learnt through problem-solving experience (equilibrium). The use of mathematical language, cultural artefacts, pedagogies and classroom organisation during problem-solving creates a mathematics learning environment.[8] The use of culturally relevant pedagogies will bridge the social and cognitive gaps between the formal mathematics taught and the knowledge background of learners. Pedagogies, organisation of group work and the language of communication determine the social participation of learners to interact

[2] Adu and Duku, "Learning Styles and Instructional Materials as Correlates of Grade 6 Learners' Mathematics Performance in Buffalo City, South Africa."
[3] T. Madosi, "Values That Grade 9 Learners from a Public School in the Ekurhuleni District of Gauteng Associate with Mathematics Learning" (University of Johannesburg, 2019).
[4] Kemi Olukemi Adu, Nicky Pylman, and Emmanuel Olusola Adu, "Learning Styles as Correlates of Grade 6 Learner's Mathematics Performance in Buffalo City Municipality in South Africa," *E-Bangi Journal* 17, no. 5 (2020).
[5] Lungiswa Kopolo, "Assessing the Impact of Qualified Mathematics and Science Teachers in the Buffalo City Area," *Unpublished Masters Dissertation, of the Nelson Mandela Metropolitan University, Port Elizabeth*, 2009;
[6] K O Adu, J Mathwasa, and E O Adu, "Textbook Utilisation in Teaching Mathematics in Selected Primary Schools in East London Education District," *E-BANGI* 17, no. 2 (2020): 156–70.
[7] Kopolo, "Assessing the Impact of Qualified Mathematics and Science Teachers in the Buffalo City Area."
[8] Kopolo, "Assessing the Impact of Qualified Mathematics and Science Teachers in the Buffalo City Area"; Adu and Duku, "Learning Styles and Instructional Materials as Correlates of Grade 6 Learners' Mathematics Performance in Buffalo City, South Africa."
[9] Madosi, "Values That Grade 9 Learners from a Public School in the Ekurhuleni District of Gauteng Associate with Mathematics Learning."

and deal with the task at hand. Therefore, this study attempts to examine the correlates of teachers' experience in mathematics learning environments in some selected schools in Buffalo City Metropolitan.[9]

Research Questions

1. How does the learning environment affect the academic performance of learners in mathematics?
2. What are the environmental factors that affect the learning of mathematics?
3. How well does the learning environment contribute to learners' progress and achievement?

LITERATURE REVIEW

The following are reviewed in line with the research objectives.

Learning Environment and its Influence on the Academic Performance of Learners in South Africa

The changing education system, with its elegant policies, strategies, technology, and resources, seems to be creating more confusion, frustration, and failures. The performance and output of the system in terms of pass rates and quality have become a controversial national subject. There is wide popularity of unfavourable comparisons with similar international education systems. The rapidly changing education system within the schools, institutions of higher learning, and education authorities continue to have a notable impact on classroom environment research. The concern is about how such change affects classroom environments and how change is sensitive to different particular school or class contexts.

In the sense of the education system, the classroom environment is the mixture of influences, school management, teacher attributes, pedagogy, motivations, frustrations and expectations, national policy, and lower authorities; management, support and resources; and their inter-relationships that exert an impact on the output or effectiveness of the classroom. Classroom environments represent one level of education where all educational activities take place.[10]

There is a concern that learners, despite well-structured educational systems spanning over 12 years of schooling, occasionally perform poorly in academic endeavours. Learning environments can impede or support learners' academic success. Similar issues can extend to South African learners who do not attend or drop out of school, attend school irregularly, or do not perform well academically. Each of these instanced academic success issues serves to examine academic performance in a South African context. Environmental factors impacting South African learners' decision to attend school, attend consistently, or perform well academically can extend to other developing nations regarding school infrastructures, educational spending, educator availability or quality, and socio-economic status.[11]

South African school scoring systems traditionally rank educational performance against predetermined benchmarks. The difficulties found in South Africa relate to learners constrained by specific environmental, socio-economic, physical, and health conditions. South Africa reflects learning barriers in impoverished communities, learners in poor health, early pregnancy, violence and safety concerns, and vehicular risks. All of these can create barriers to school attendance and supply support questions on school attendance. While some of these indicators might be viewed as socio-political concerns beyond the educational scope, educational factors such as dropout rates, school attendance tracking, the effect of adolescent employment, and the consequences of out-of-school households are valid points of investigation concerning the country's learning environment and academic success.[12]

Environmental Factors that Affect the Learning of Mathematics in South Africa

Mathematics plays an important role in South African education. It is one of the most important subjects in school education and has a strong presence in the school curriculum because of its varied applications. Nevertheless, South African learners' performance in mathematics is a cause for concern. In the Third International Mathematics and Science Study (TIMSS 2003 and 2007) studies, South African learners

[10] Adu and Duku, "Learning Styles and Instructional Materials as Correlates of Grade 6 Learners' Mathematics Performance in Buffalo City, South Africa."
[11] Njabulo Sithole, "Promoting a Positive Learning Environment: School Setting Investigation" (University of South Africa, 2017).
[12] Simona Maraschin, "Factors Influencing Enrolment and Academic Performance at a South African University" (University of the Witwatersrand, 2008).
[13] Sithole, "Promoting a Positive Learning Environment: School Setting Investigation."

were shown to have a below-standard performance when compared to other participating countries.[13] Children are not engaging with and enjoying mathematics, subsequently leading to negative experiences in more formal school contexts. How children develop mathematical thinking is shaped not just by their cognitive responses to learning opportunities framed by teachers but also by social and cultural factors. Their responses, in turn, shape classroom processes as learners' mathematical thinking is taken up by a teacher. Teaching is not just a consideration of what is written in policy documents or articulated in the professional domain of lesson observations, teachers' guides, and so on. It is also the multifaceted doing of complex mathematical actions that involve the social, cultural, and institutional setting of classrooms.[14]

Environmental factors can impact the mathematical achievement and performance of school children negatively. There is a vast gap in the availability of resources provided to learn mathematics formally between urban and rural schools. For example, the presence of inadequately trained mathematics teachers was experienced more strongly in rural schools. Furthermore, when mathematics misconceptions were investigated between rural and urban schools, it was found that all schools displayed misconceptions, but urban schools were less affected by misconceptions. Hence, the notion of the classroom as a context becomes relevant for studies in mathematics education. The more immediate context of interest is the primary (foundation) school mathematics classroom that is the focus of this study.[15]

Mathematics is an important subject in South African schools. It helps students think together, understand how numbers work, and be good citizens. Good mathematics skills are necessary for jobs that need using numbers and thinking smartly.[16] The teaching of mathematics in South African schools faces many challenges, which might not always be easy to see. One reason is that not thirty percent of primary school students pass maths, according to the January 2012 National Education Annual Report. In some schools, 100% of children fail mathematics in the elementary grades. Another reason is that black and white South African math education is racially divided and not equitable. Many conditions related to curriculum, teaching and learning materials, classroom coverage, teacher biases, and particular school environments contribute to each child's differential educational opportunity.[17]

Mathematics is a 'hard' science subject at school. Many students like doing mathematics because it is interesting, while many dislike studying it because it is challenging. Many other conditions influence the teaching and learning of mathematics in schools, like the availability of mathematical teaching aids, the socio-economic state of the family surrounding the learners, the nature of the school (urban or rural), and class size.

Learning Environment and its Influence on the Academic Performance of Learners in South Africa

The South African educational system has experienced various social, political, and economic changes which complicated its progress. However, despite these determined efforts, the progression has not changed the education quality drastically, and many South African learners acquire qualifications that do not reflect the requisite skills and knowledge. Following assessment studies, it has been recognised that many learners' problems could stem from the different learning environment species they come from. Namely, the educational environment of learners has an impact on their academic progress.[18]

Examination of the environment in which learners school reveals that learners schooling in a different environment of schooling comes with differences in schooling outside of the classrooms itself. Several outcomes can be detected through several factors, including schooling activities, parent involvement and commitment towards the learning processes, teacher improvements and levels of professionalism, classroom size, teacher-pupil ratios, extra-mural academic assistance programs,

[14] Maphetla M Machaba and Maphetla M Machaba, "Aspects That Pose Challenges in the Teaching of Mathematics at Grade 3 Level," *Mediterranean Journal Os Social Sciences* 5 (2014).
[15] Madosi, "Values That Grade 9 Learners from a Public School in the Ekurhuleni District of Gauteng Associate with Mathematics Learning."
[16] Machaba and Machaba, "Aspects That Pose Challenges in the Teaching of Mathematics at Grade 3 Level."
[17] Machaba and Machaba, "Aspects That Pose Challenges in the Teaching of Mathematics at Grade 3 Level."
[18] Madosi, "Values That Grade 9 Learners from a Public School in the Ekurhuleni District of Gauteng Associate with Mathematics Learning."
[19] Zelda Joy Le Roux, "An Application of Brain-Based Education Principles with ICT as a Cognitive Tool: A Case Study of Grade 6 Decimal Instruction at Sunlands Primary School," 2015.

numbers of feeding schemes and the well-being of learners. It is proposed that measuring the learning environment could be of utmost importance in understanding learners' variance achievement and progress. This also emphasises equal opportunities for all learners in accessing qualified schooling environments, especially in a multicultural and diverse context like South Africa and globally.[19]

THEORETICAL FRAMEWORK

Constructivism Theory

Constructivism is one of the most widely used theories in mathematics education research. The theory posits that learners actively construct their mathematical understanding through experiences and interactions with their environment. Learning is seen as a process of internalising and adapting concepts through exploration, problem-solving, and reflection.[20] Constructivism theory, especially as it applies to mathematics learning, has significant implications for both teaching practices and the learning environment. Constructivism, based on the idea that learners actively construct their understanding and knowledge through experiences and interaction with the world, emphasises the role of the learner as an active participant rather than a passive recipient of information. In the context of mathematics education, this perspective shapes how learning environments are structured, how content is delivered, and how students engage with mathematical concepts.[21]

Implications of Constructivism for Mathematics Learning

According to Minarni and Napitupulu, constructivism emphasises that learning mathematics is not just about memorising facts or formulas but about understanding underlying concepts through active exploration, availability of a conducive environment and inquiry.[22] Learners should be encouraged to solve problems by themselves, discover patterns, and construct solutions. This promotes deep understanding rather than superficial learning. Teachers act as facilitators, guiding learners to explore mathematical ideas rather than delivering direct instruction. Students take ownership of their learning by actively engaging with mathematical problems and reflecting on their processes.

In constructivism, learners build new mathematical understanding on the foundation of what they already know. This means teachers must assess students' prior knowledge and connect new mathematical concepts to their existing knowledge base. Teachers provide support or scaffolding to help students make connections between previous knowledge and new mathematical ideas. Over time, this scaffolding is gradually removed as students gain more confidence and independence.[23]

Constructivism emphasises the importance of students developing a deep, conceptual understanding of mathematical principles rather than simply memorising rules or procedures. Encouraging students to represent mathematical ideas in different ways (e.g., visually, algebraically, or through real-life contexts) helps them internalise abstract concepts and see the connections between different representations. Collaboration and communication with peers are crucial in a constructivist learning environment. Group work and discussion allow learners to explain their thinking, ask questions, and build on others' ideas, which deepens their understanding of mathematical concepts. The use of dialogue, where learners explain and justify their reasoning, helps them clarify and refine their mathematical thinking. This process is key to the social aspect of learning in constructivist theory.[24]

Constructivism encourages the use of real-world problems to make mathematics meaningful and relevant to students. These problems should be complex enough to require critical thinking and application of multiple mathematical concepts. By embedding mathematical problems in real-life or culturally relevant contexts, students see the utility of mathematics and can relate abstract concepts to

[20]Sithole, "Promoting a Positive Learning Environment: School Setting Investigation."
[21] Koeno Gravemeijer, "A Socio-Constructivist Elaboration of Realistic Mathematics Education," *National Reflections on the Netherlands Didactics of Mathematics: Teaching and Learning in the Context of Realistic Mathematics Education*, 2020, 217–33.
[22] S H Voon and Mohd Syawal Amran, "Pengaplikasian Teori Pembelajaran Konstruktivisme Dalam Pembelajaran Matematik: Application of Constructivism Learning Theory in Mathematical Learning," *Sains Insani* 6, no. 2 (2021).
[23] Ani Minarni and E Elvis Napitupulu, "The Role of Constructivism-Based Learning in Improving Mathematical High Order Thinking Skills of Indonesian Students," *Journal of Mathematics Education (INFINITY)* 9, no. 1 (2020): 111–32.
[24]Gravemeijer, "A Socio-Constructivist Elaboration of Realistic Mathematics Education."
[25] Chen Xie, Mingshuai Wang, and Huimin Hu, "Effects of Constructivist and Transmission Instructional Models on Mathematics Achievement in Mainland China: A Meta-Analysis," *Frontiers in Psychology* 9 (2018): 1923.

practical situations they encounter in everyday life. Students are encouraged to reflect on their thinking processes and learning strategies (metacognition), which helps them become more aware of how they solve problems and how they can improve. Constructivism promotes the idea that mistakes are an essential part of learning. Teachers should create environments where students feel comfortable making mistakes, reflecting on them, and using them as learning opportunities.[25]

METHODOLOGY

Research Paradigm

The transformative paradigm, which was used in this work, assumes that power is a problem that needs to be addressed throughout the entire research process. The teachers' experience in the mathematics learning environment has emerged as a challenge that opens doors to the invention of new environmental strategies to promote effective teaching and learning of not only mathematics but all other subjects. This will give a proper direction and make an important decision.[26]

Research Approach

The qualitative research approach was adopted because it incorporates a social and natural environment where people experience the parts of their lives and interact with chosen others in their settings. The teachers' experience in the mathematics learning environment is an in-depth phenomenon that only the qualitative research approach can unpack.[27] It also implies how interactions between learners and their environment shape their effective assimilation and application of what is learnt into their society.

Research Design

For this work, a phenomenological case study design was chosen because it allows for a thorough comprehension of occurrences using semi-structured, in-depth interviews that record the participants' lived experiences on how their environmental factors affect the teaching and learning of mathematics. This would enable people to comprehend how the resources at their disposal support the teaching of mathematics.[28]

Sampling and Instrumentation

For this study, twelve teachers from six schools in Buffalo Metropolitan City, East London, South Africa, were selected using criteria and purposeful selection techniques because teachers with more than five years of experience and a mixture of rural and urban school teachers were selected. The respondents were questioned in a semi-structured interview manner to gather information. The respondents were coded as P1-P12, where P1 means participant 1 and P12 means the twelfth participant.

Trustworthiness

Credibility, transferability, dependability, and confirmability are all guaranteed when participants are allowed to view the research's conclusions and provide their assent.[29] By using the data gathered, the researcher attempted to avoid any data manipulation and to accurately and impartially represent the perspectives of the research participants.

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[26]Ngan Hoe Lee, June Lee, and Zi Yang Wong, "Preparing Students for the Fourth Industrial Revolution through Mathematical Learning: The Constructivist Learning Design," *Journal of Educational Research in Mathematics*, 2021.

[27] John W Creswell, *A Concise Introduction to Mixed Methods Research* (SAGE publications, 2021); Monde Kazeni and Nosipho Mkhwanazi, "Life Sciences Teachers' Understanding, Perceptions and Adoption of Inquiry-Based Science Education in Selected South African High Schools," *Education and New Developments* 27 (2020).

[28] Emmanuel Olusola Adu and Roy Tokunbo Olowu, "Teachers' Perceptions of How Global Citizenship Education Promotes Problem-Solving Skills and Conflict Resolution in Nigeria," *International Journal of Social Sciences & Educational Studies* 9, no. 4 (2022): 54–67; Kazeni and Mkhwanazi, "Life Sciences Teachers' Understanding, Perceptions and Adoption of Inquiry-Based Science Education in Selected South African High Schools."

[29] Kazeni and Mkhwanazi, "Life Sciences Teachers' Understanding, Perceptions and Adoption of Inquiry-Based Science Education in Selected South African High Schools"; Adu and Olowu, "Teachers' Perceptions of How Global Citizenship Education Promotes Problem-Solving Skills and Conflict Resolution in Nigeria."

[30] Sawsan Abutabenjeh and Raed Jaradat, "Clarification of Research Design, Research Methods, and Research Methodology," *Teaching Public Administration* 36, no. 3 (October 24, 2018): 237–58, https://doi.org/10.1177/0144739418775787; Adu and Olowu, "Teachers' Perceptions of How Global Citizenship Education Promotes Problem-Solving Skills and Conflict Resolution in Nigeria."

Data Analysis

Thematic analysis of the data involved familiarising oneself with the data, creating a code, looking for the theme, and transcribing the data. The research questions served as the basis for the subject.

PRESENTATION OF FINDINGS

The data was analysed using a thematic approach according to the research questions postulated in this paper.

Research question 1: How does the learning environment affect the academic performance of Learners in South Africa?

Table 1: Theme and sub-themes relating to how the learning environment affects the academic performance of Learners in mathematics

Theme	Sub-themes	Activities
Learning environment and its effect on the academic performance of Learners in mathematics.	Adequate resources	• The use of modern resources with manageable class size
	Dynamics and innovative teaching	• The interactive feedback and accommodating the needs of the learners
	Effective planning of lesson activities	• The contents of the lesson plan must be holistic to promote societal development and appropriate application.
	Learner engagement	• Development in learners positive attitude, interaction, and support

All the respondents indicated that adequate and modern resources, dynamics and innovative teaching, effective planning of lesson activities and thorough learning engagement are the needed environments that can promote learners' performance in mathematics. However, some participants enunciated the following.

> P6: *Take the time to celebrate even the smallest of wins for learners who are sometimes reluctant to participate in class. Providing praise for a job that's well done goes a long way toward building trust and helping students feel seen.*
>
> *P7: The most common types of learning environments are learner-centred, knowledge-centered, assessment-centered, and community-centered. Learner-centred learning environments focus on the individual and collective learners and their needs*
>
> *P10: Building positive relationships through communication. Promote class discussion and peer interaction. Staying connected with students. Coming up with projects that learners can get excited about will enhance their performance.*
>
> *P11: Encouraging the learners to be involved in learning and get feedback from the teachers, and teachers must always tell the students what is expected from them*
>
> *P12: Developing and reinforcing classroom rules and norms that clearly support safe and respectful positive behaviour. Having classroom rules helps*

you to create a predictable, safe learning environment for your learners. Rules give your learners clear boundaries and opportunities to practice self-regulation and make good choices.

The Learning Environment and its Effect on Academic Performance of Learners in Mathematics

Adequate resources, dynamic and innovative teaching and learner engagement revealed in this study are some of the key variables that influence academic performance in mathematics. Studies about the learning environment have led to confusion, dissatisfaction, and failures as a result of the evolving educational system despite its sophisticated rules, methods, technology, and resources.[30] The system's output and performance in terms of pass rates and quality have generated national debate. Unfavourable comparisons of performance in mathematics with comparable international education systems are quite common. Research on classroom and learning environments may have been significantly impacted by the quickly evolving educational system in schools, colleges, and education authorities.[31] The impact of such changes on classroom settings due to environmental factors and how adaptable they are to various unique school or class situations are the areas of focus.

Research question 2: What are the environmental factors that affect the learning of mathematics?

Table 2: Theme and sub-themes relating to the environmental factors that affect the learning of mathematics

Theme	Sub-themes	Activities
The environmental factors that affect the learning of mathematics	Quiet environment for maximum concentration	• Noisy and dirty environments can affect the learning of mathematics. • The mastery skills of learners are always affected when there is no maximum concentration.
	Library facilities	• Learners are able to engage in different methods of mathematical understanding through different sources. • Library facilities encourage learners to study more.
	Constant supply of electricity	• Most learners want to study at night for maximum concentration and electricity is quite helpful, if there is no power/electricity then they get discouraged.

The participants reiterated the importance of environmental factors to promote the learning of mathematics and foster better understanding. They believed that conducive environmental factors allow learners to synthesise information and apply it. Appropriate environmental factors help learners to navigate difficult topics and promote learners' interest in the subject matter. A few of the participants have the following to say.

P1: A conducive environment can lead to behavioural and emotional changes, loss of motivation, fatigue at the end of the day, and more. The auditory environment can also become a vicious cycle; the louder the classroom, the

[31] Sithole, "Promoting a Positive Learning Environment: School Setting Investigation."
[32] Madosi, "Values That Grade 9 Learners from a Public School in the Ekurhuleni District of Gauteng Associate with Mathematics Learning."

more students will have trouble concentrating, which leads them to be even louder.

P3: Environmental factors could affect how much time the teacher can focus on individual students and their specific needs rather than on the group as a whole. Since it is easier to focus on one individual in a smaller group, the smaller the class size, the more likely individual attention can be given, in theory at least.

P4: Independent learning is encouraged when learners have access to a library in schools, and this is essential for the development of academic literacy skills

P5: The sudden power outages can lead to interruptions in virtual classes, causing learners to miss important lessons, discussions, and assignments. The lack of a reliable power supply also affects the functioning of electronic devices, such as laptops and tablets, which are essential for online learning

P8: Learners who study in a positive learning environment are more motivated, engaged, and have a higher overall learning ability.

The Environmental Factors that Affect the Learning of Mathematics

The quiet environment for maximum concentration, library facilities and constant supply of electricity. Other factors like attitudes of teachers and learners towards mathematics, language in the classroom, availability of mathematical teaching aids, socio-economic state of the family surrounding the learners, nature of the school (urban or rural), and class size are some of the environmental factors revealed that can have an impact on the learning of mathematics. These are in support of Madosi, who believed that these factors are very imperative and that school leadership should be cognizant of them.[32] An important subject in South African schools is mathematics. It fosters cooperative thinking, an understanding of mathematics, and civic virtue in learners. Proficiency in mathematics is essential for employment, requiring the use of numbers and analytical thinking, which can only be achieved through utilisation and positive interaction with environmental factors.[33]

Research Question 3: How well does the learning environment contribute to learners' progress and achievement?

Table 3: Theme and sub-themes concerning how the learning environment contributes to learners' progress and achievement

Theme	Sub-themes	Activities
Learning environment and its contribution to learners' progress and achievement	The use of technology	• This simplifies mathematical understanding, especially the use of telematics.
	The inclusion of hybrid/blended learning options	• It allows learners of different cognitive abilities to engage and help/assist each other to understand.
	Remedial intervention and enrichment programmes	• This gives a positive and confident approach to understanding and mastery of the subject.

[33] Madosi, "Values That Grade 9 Learners from a Public School in the Ekurhuleni District of Gauteng Associate with Mathematics Learning."
[34] Machaba and Machaba, "Aspects That Pose Challenges in the Teaching of Mathematics at Grade 3 Level."

	The monitoring of homework and feedback on assessment tasks	• It gives them feedback and encouragement to practise and promote mathematical understanding.

Virtually all the participants confirmed that the learning environment contributes to learners' progress and achievement. Similarly, it will enhance the hands-on experience, memory and better understanding of mathematical concepts being taught in school. Some participants have the following specific reasons to say.

> *P3: Technology can help learners visualise abstract mathematical concepts, make connections between mathematical ideas and actively engage with the material. This can lead to increased learner engagement, interest, and motivation in learning mathematics.*
>
> *P7: Blended learning in the social constructivist nature of learning provides learners with opportunities to relate abstract concepts to real-life situations more easily. This is because of the use of technology and different forms of learning opportunities that are blended into the learning process.*
>
> *P9: In mathematics, each concept is the foundation for new learning, and when a learner has not mastered one concept, they are unable to move on to the next concept. In this case, remediation helps to get the learners back on track so they can continue their learning on the mathematics continuum.*
>
> *P12: Students need to learn to monitor and evaluate their progress. When learners are encouraged to assess their learning, they become more aware of what they know, how they learn, and what resources they use when they do mathematics.*

Reasons Why the Learning Environment Contributes to Learners' Progress and Achievement

The use of technology, the inclusion of hybrid/blended learning options, remedial intervention and enrichment programmes with the monitoring of homework and feedback on assessment tasks can help learners visualise abstract mathematical concepts, make connections between mathematical ideas and actively engage with the material.[34] This can lead to increased student engagement, interest, and motivation in learning mathematics. Similarly, learners who are treated with respect, liberty, equity, and fairness are better able to develop their intellectual, emotional, and social capacities. By being aware of the nature of education, curriculum, and instruction, as well as testing and performance diagnostics, they would be able to address the learning challenges brought on by the heterogeneous nature of the learning environment.[35]

Discussion Summary

Teachers' experiences concerning mathematics learning environments can vary significantly based on several factors, including the structure of the learning environment, teaching styles, available resources, and their attitudes toward mathematics. Teachers' experiences in mathematics learning environments are multifaceted, ranging from highly positive to deeply challenging. The key to enhancing these experiences often lies in creating a balanced and supportive atmosphere where learners feel empowered to explore mathematical ideas at their own pace and with confidence. A common experience for many learners is anxiety or fear related to learning mathematics. This can arise from previous failures, fear of making

[35]Anvarjon Rashidov, "Use of Differentiation Technology in Teaching Mathematics," *European Journal of Research and Reflection in Educational Sciences Vol* 8, no. 7 (2020).

[36] Le Roux, "An Application of Brain-Based Education Principles with ICT as a Cognitive Tool: A Case Study of Grade 6 Decimal Instruction at Sunlands Primary School."

mistakes, or the perception that mathematics is inherently difficult. Learners who grasp mathematical concepts or successfully solve challenging problems often report a deep sense of accomplishment and satisfaction due to the positive environment of mathematics. Some students experience feelings of frustration, especially when they encounter abstract concepts or struggle with understanding certain topics, leading to disengagement or a negative attitude toward the subject. Positive experiences, such as success in solving problems or praise from teachers, can build self-confidence, making learners more willing to engage with difficult tasks in the future. Learners who perceive their classroom as a safe and supportive space tend to engage more actively. They feel comfortable asking questions and expressing confusion without fear of judgment.

RECOMMENDATIONS

The study recommends the following, among others, which the teachers, school management, and education stakeholders should provide.

- Supportive Classroom Atmosphere: Students tend to engage more positively when they perceive the material as relevant to their lives or future goals. Teachers who relate mathematical concepts to real-world applications or personal interests often create a more meaningful learning experience for students.
- Collaborative Learning: Experiences with group work and peer discussions can foster positive learning experiences. Students often benefit from explaining concepts to one another, gaining new perspectives, and working collaboratively to solve problems.
- Teacher Support and Interaction: The way teachers interact with students is a major factor. Teachers who offer clear explanations, provide constructive feedback, and are approachable contribute to a positive learning experience. Conversely, a lack of support or overly critical feedback can create a hostile learning environment.
- Classroom Dynamics: Students often notice the competitiveness or collaboration fostered within their learning environment. In highly competitive settings, some students may feel discouraged, while in more cooperative settings, students feel encouraged to support each other.
- Pace of Learning: The speed at which material is covered impacts learners differently. Some students may feel left behind in fast-paced environments, while others may feel unchallenged by slower-paced instruction. This affects how confident and engaged they feel in the classroom.
- Technology in Mathematics Learning: Technology like interactive apps, online resources, graphing calculators, and virtual learning platforms can enhance students' experiences by making abstract concepts more tangible. However, some students may feel overwhelmed by technology or struggle to access it outside of the classroom.

CONCLUSION

The paper explores Grade 9 teachers' experiences in mathematics learning environments. This is very crucial for understanding the challenges, practices, and dynamics that influence teaching effectiveness and student engagement. Research into this area helped to identify various factors that influence the learning of mathematics which the paper unpacked. Such factors that were revealed by this paper include curriculum design, classroom dynamics, instructional strategies, and availability of resources. The understanding of these factors can assist the teachers to promote and enhance effective teaching of mathematics and later lead to the achievement of the learning outcome.

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