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Factors Influencing the Academic Performance of Female Physical Science Learners in Limpopo Province, South Africa

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Abstract

Despite increased enrolment in science, technology, engineering, and mathematics (STEM) subjects, female learners face systemic barriers such as limited mentorship and socio-economic constraints, influencing their academic success and career aspirations. This study used a qualitative, phenomenological approach to explore factors affecting the academic performance of female Physical Science learners in the Capricorn South District of the Limpopo province in South Africa. Twelve participants were purposively selected and interviewed. Semi-structured interviews were employed to focus on academic performance. Measures of trustworthiness ensured rigour, and ethical approval was obtained from the Turfloop Research Ethics Committee (TREC). Confidentiality, voluntary participation, and secure data storage were maintained throughout the study. The study was based on feminist science theory (FST). The findings show that learners' performance in Physical Science is influenced by various factors, including motivation, career aspirations, comprehension, and support systems. Support from family, peers and teachers plays a crucial role, with emotional and gender-based differences affecting academic performance. Interventions should prioritise structured academic support including remedial programmes, peer-assisted learning, and personalised tutoring, especially for female learners from disadvantaged backgrounds, in order to improve performance.

Keywords: academic performance; female learners; gender; Physical Science

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1. Introduction

Despite ongoing efforts to promote inclusivity and equal access, gender disparities in science, technology, engineering, and mathematics (STEM) education remain a persistent challenge globally (Stoet & Geary, 2018; Charlesworth & Banaji, 2019). While the enrolment rates of female learners in STEM fields have improved, significant barriers continue to affect their participation, engagement, and academic performance, particularly in subjects like Physical Science (Stoet & Geary, 2018). Female learners often encounter systemic obstacles that hinder their success, including negative learning experiences, and entrenched gender stereotypes (Sithole et al., 2017). In South Africa, while more female learners are enrolling in science-related subjects, their experiences in Physical Science classes remain paradoxical, limiting their academic progress and their overall participation in Physical Science (Kibirige & Modjadji, 2022; Naidoo & Sibanda, 2020).

Prayogi and Verawati (2024) point out that the learning environment plays a crucial role in shaping the academic experiences of female learners in Physical Science. Teachers, peers, and family support can either enhance or hinder academic success (Berardi & Morton, 2017). According to Leaper and Starr (2019), many female learners report feelings of exclusion,

gender bias, and a lack of mentorship, which negatively influence their motivation and self-efficacy. Stereotypical perceptions of Physical Science as a male-dominated discipline further contribute to these difficulties, often leading to lower confidence and disengagement among female learners (Banchefsky & Park, 2018). These diverse experiences highlight the need to examine how gender and academic performance intersect to shape female learners' experiences in Physical Science. Beyond the classroom, socio-cultural and economic factors further influence female learners' participation in Physical Science (Fussy et al., 2023). In many communities, traditional gender roles place additional household responsibilities on girls, limiting their study time and engagement in STEM subjects (Kim et al., 2018). Additionally, financial constraints, inadequate learning resources, and a lack of visible female role models in STEM careers exacerbate these challenges (Olatunde-Aiyedun et al., 2024).

In Mauritius, teaching practices were found to play a role in alienating female learners from Physical Science classes (Naugah & Watts, 2013). Research conducted in parts of South Africa showed that female learners experience gender-based biases in their Physical Science classes (Mathibela & Masinire, 2024) and that this affects their academic performance (Chakawodza, 2018). Despite existing research on gender disparities in STEM education in South Africa, there is still a notable gap in studies focusing on the lived experiences of female learners in Physical Science in rural and underrepresented regions of the Limpopo province, such as the Capricorn South District. This study seeks to focus on this gap by providing an in-depth analysis of the factors that influence the performance of female learners in Physical Science classrooms. Unlike previous studies that focused predominantly on external barriers such as infrastructure and resource limitations, the purpose of this study is to examine the day-to-day classroom experiences of female learners, offering a nuanced perspective on how social interactions, gender dynamics, and institutional support affect their academic performance (Fernandez, 2023).

Numerous studies have examined the inclusion of female learners in science education and have highlighted the importance of creating equitable and supportive learning environments (Collins et al., 2025). Despite these efforts, there remains a need to understand how female learners themselves experience Physical Science within their specific educational contexts. Therefore, this study was guided by the following research question: How do female learners experience and navigate Physical Science, and what factors influence their experiences and academic success? More specifically, the study explored the role of support systems, school context, and participation in extracurricular activities in shaping female learners' experiences in Physical Science.

2. Materials and Methods

2.1. Research Approach

This study adopted a qualitative research approach, which is well suited for exploring the complex and subjective experiences of female Physical Science learners. The qualitative nature of the study enabled a deeper understanding of the personal, social, and educational factors influencing their academic performance and the support systems available to them.

2.2. Research Design

A phenomenological design was employed to examine the lived experiences of female learners in Physical Science. This design was deemed appropriate because it focuses on understanding participants' perceptions, experiences, and meanings attached to a particular phenomenon. The study sought to investigate how female learners perceive and navigate the experiences they encounter in Physical Science, as well as the challenges and the support systems that contribute to their academic success. Data were collected through

semi-structured, in-depth interviews, which provided participants with the opportunity to share their personal experiences and perspectives in detail. The flexible nature of the phenomenological approach enabled the researcher to probe further into emerging issues, yielding rich and nuanced insights into the relationship between female learners' experiences and their academic performance in Physical Science. By foregrounding the voices and lived experiences of female learners, the phenomenological design aligned with the principles of feminist science theory (FST), which emphasises the importance of understanding knowledge production from the perspectives of historically underrepresented groups in science.

2.3. Setting and Participants

The study was conducted in selected public and private secondary schools within the Capricorn South District of the Limpopo province in South Africa. These schools were strategically chosen to ensure representation from both urban and rural environments, capturing diverse educational experiences and challenges faced by female learners in Physical Science. The study setting was carefully considered to reflect the broader learning conditions that may contribute to the factors affecting learners' performance. The selected schools included one private school in a rural area, two public schools in a rural area and one public school in an urban area.

2.4. Theory

Feminist science theory (FST) is an interdisciplinary field of study that applies feminist perspectives to the philosophy and practice of science. It critically examines how gender influences the production of scientific knowledge, the methods employed in scientific inquiry, and the representation of gender within scientific disciplines (Bluhm et al., 2012). FST theory was used as a lens throughout the study.

Limpopo has approximately 4015 public schools across various quintiles. It is also home to approximately 130 private schools, located in both rural and urban areas (Limpopo Department of Education, 2026). Four schools were chosen to take part in the study. One was a public school in the urban area (quintile 5), the second and third schools were public schools in the rural area (quintile 2), while the fourth school was a private school in the rural area. The researchers approached a private school in an urban area, but access to the learners was denied. The schools represented a diverse group of the different types of schools in South Africa. Schools in South Africa are ranked into quintiles, with quintile 1 receiving more government funding and usually located in deep rural areas with predominantly low-socioeconomic-status households. Quintile 5 schools receive less funding from the government and are usually in urban areas, surrounded by houses with employed individuals (MacGregor & Ross, 2025).

The study specifically targeted female Grade 12 learners enrolled for Physical Science. A purposive sampling strategy was employed to select participants with direct experience of the subject, ensuring that the study captured relevant insights into the factors influencing their performance. A total of twelve female learners participated in the study. Participant recruitment and analysis occurred concurrently, consistent with phenomenological research practice. Following each interview, transcripts were reviewed and coded to identify emerging meanings, patterns, and themes related to learners' experiences in Physical Sciences. This iterative process enabled the researcher to monitor the development of codes and themes throughout data collection. The study reached thematic saturation at the fourth school and the twelfth participant. Thematic saturation was defined as the point at which no new codes or themes had been consistently repeated across participants. Eligibility criteria required participants to be:

- at least 18 years old,
- actively enrolled in Grade 12 Physical Science,
- proficient in either Sepedi or English, to facilitate effective communication during interviews.

Since Sepedi was the dominant home language in the selected schools, it played a crucial role in shaping the linguistic and cultural context of the study, allowing participants to express their experiences in a familiar language.

2.5. Data Collection and Analysis

Participants were recruited within their respective schools, and those who met the inclusion criteria were provided with detailed information about the study before giving written informed consent, in line with the ethical principles for research involving human participants (Creswell & Creswell, 2017). Prior to the interviews, participants completed a brief sociodemographic questionnaire to capture relevant background information that could contextualise their experiences. Semi-structured, in-depth interviews were conducted in a private, distraction-free space on the school premises to ensure confidentiality and participant comfort, both of which are considered essential for generating rich qualitative data (Kvale & Brinkmann, 2009). Most interviews were conducted in Sepedi, the home language of all participants, allowing them to articulate their experiences more fully and authentically. Conducting interviews in participants' first language enhances meaning making and reduces the risk of misinterpretation (Temple & Young, 2004). The inclusion of the home language was further informed by FST, which, according to Middleton (2024), emphasises inclusivity, equity, and the validation of participants' voices within their sociocultural contexts.

Interview questions were developed by the researcher and approved by the supervisor to ensure methodological rigour and alignment with the study objectives. Each interview lasted between 30 and 45 min, allowing for in-depth engagement and the exploration of participants' perspectives. With participants' explicit consent, all interviews were audio-recorded to ensure accurate data capture and reliability of findings (Creswell & Poth, 2016). As recommended to enhance credibility and trustworthiness, reflexivity and bracketing were systematically employed, minimising researcher bias in the data collection process (Tufford & Newman, 2012; Vansoeterstede et al., 2024).

The background of the researcher as a qualitative research specialist, together with an interpersonal approach that encourages open dialogue without leading participants, contributed to the generation of authentic responses. As a feminist researcher, particular attention was given to managing subjectivity and maintaining awareness of potential biases, consistent with feminist methodological principles that advocate reflexive and ethical engagement (Harding, 2023). The researcher's experience in qualitative research across multiple university-based projects, along with formal master's-level training, enhanced her competence in conducting rigorous and effective qualitative interviews.

2.6. Interview Protocol

Interviews were conducted in a designated, quiet area on the school premises. One-on-one semi-structured interviews were conducted without any issues. The researcher (a PhD student at the time; now a PhD holder) conducted all the interviews. A voice recorder was used to record the interviews.

2.7. Interview Questions

1. Which level did you achieve in Physical Science in your mid-year examination?
2. Tell me something about the career that you would like to pursue.

3. Do you enjoy Physical Science classes?
4. Do you think you need extra classes? If yes, would you prefer the current teacher to offer them, or would you like someone else to present the extra classes?
5. Do you cope with homework given to you per day?
6. Kindly elaborate on the support/lack of support you experience at home in terms of your studies in Physical Science.
7. Between boys and girls in your class, which group do you prefer to assist you with Physical Science content? Why?
8. Is there anything from home that you feel disturbs you from focusing on your Physical Science lessons?

A thematic analysis approach, guided by Creswell and Poth (2016), was employed to systematically analyse the data. As most interviews were conducted in Sepedi, all audio recordings were first transcribed and then translated into English prior to analysis. The translation process involved carefully listening to each recording, pausing, and producing a direct English transcription. To enhance translation validity and preserve the original meaning, the researcher remained attentive to linguistic nuances, cultural expressions, and contextual meanings embedded in participants' responses. This was possible because the researcher is also a Sepedi primary speaker. This ensured that the integrity and authenticity of the data were maintained throughout the analytic process.

The analysis followed several iterative and interconnected steps. Familiarisation involved repeated reading of the transcripts to develop a deep and holistic understanding of participants' experiences. During this phase, the researcher engaged reflexively with the data by documenting initial observations, recurring patterns, and emerging ideas related to female learners' experiences in Physical Science. The researcher was also guided by FST, which sensitised the analysis to issues of gender, power relations, access to scientific knowledge, and the social and cultural factors shaping female learners' experiences in science education. No qualitative data analysis software was used during the analysis. Instead, all coding and theme development were conducted manually to organise, track, and compare patterns across transcripts.

The study adopted an inductive thematic analysis approach, allowing themes to emerge directly from participants' narratives rather than being predetermined by any existing theoretical framework. Although the analysis was inductive, FST served as a sensitising lens that guided the researcher's attention to issues of gender, power relations, participation, and access to science education during the interpretation of the data. Following familiarisation, a coding framework was developed through a close examination of the transcripts. Initial open codes were generated from meaningful units of text that reflected participants' experiences, perceptions, and challenges. As coding progressed, similar codes were compared, refined, merged, or separated to create a coherent coding framework that accurately represented the dataset. The coding process remained flexible throughout the analysis, allowing new codes to be added as fresh insights emerged from the data. The emerging themes were subsequently considered through the lens of FST to better understand how social, cultural, and structural factors shaped the experiences of female learners in Physical Science.

During theme development, related codes were grouped into preliminary categories and subthemes based on conceptual similarities. These sub-themes were then organised into broader themes that captured recurring patterns across participants' accounts. Constant comparison was employed to examine similarities and differences within and across transcripts, thereby ensuring analytical depth and consistency. The preliminary themes were subsequently reviewed against the coded extracts and the entire dataset to assess their coherence, distinctiveness, and relevance to the research objectives.

To strengthen the rigour of the analysis, verification procedures were incorporated. An independent coder reviewed the transcripts, coding process, and emerging themes. A consensus meeting was held to compare interpretations and assess the consistency of the coding process. No disagreements emerged between the researcher and the independent coder, indicating a high level of consistency in the interpretation of the data and supporting the credibility and dependability of the findings.

The final phase involved refining and defining the themes. Themes were reviewed iteratively to ensure that each captured a distinct aspect of participants' experiences while maintaining internal coherence and external heterogeneity. Overlapping themes were consolidated where necessary, and theme names were revised to accurately reflect the essence of the data they represented. The final themes were then interpreted in relation to the study objectives and situated within the relevant literature and theoretical frameworks. Direct quotations were used to illustrate and substantiate the findings, ensuring that the analysis remained grounded in participants' voices. Throughout the process, reflexivity was maintained, with the researcher critically reflecting on how her positionality and perspectives may have influenced data interpretation. This transparent and systematic approach enhanced the trustworthiness, credibility, dependability, and authenticity of the study findings.

2.8. Measures of Trustworthiness

To ensure methodological rigour and trustworthiness, this study adhered to the criteria of credibility, transferability, dependability, and confirmability, as outlined in qualitative research traditions. Credibility was enhanced through prolonged engagement in the field, which allowed the researcher to build rapport with the participants and gain a deeper understanding of their lived experiences. Member checking was also employed, enabling participants to verify the accuracy of their responses and the researcher's interpretations. In addition, reflexivity was a continuous process throughout the study, with the researcher critically examining her assumptions, values, and potential influence on the research process (Tufford & Newman, 2012). Closely linked to reflexivity, positionality was acknowledged, as the researcher's identity, background, and feminist orientation informed both the research approach and the interpretation of the findings. Rather than attempting to eliminate subjectivity, it was consciously managed and used as a resource to deepen understanding while maintaining analytic rigour.

Transferability was achieved by providing thick, rich descriptions of the research context, including detailed accounts of participating schools, learner demographics, and data collection procedures. Such contextual detail enables researchers to assess the relevance and applicability of the findings to other educational settings with similar characteristics, particularly rural and urban schools. Consistent with phenomenological research, the aim was not to produce broadly representative findings but to generate an in-depth understanding of participants' lived experiences. Consequently, the findings support analytical generalisation, whereby insights may inform understanding of similar contexts and contribute to theory and practice, rather than statistical generalisation to a wider population (Crossley, 2009).

Dependability was ensured through methodological transparency and consistency across all stages of the research process. A clear and systematic research design was maintained, with detailed documentation of data collection procedures, interview protocols, and analytic decisions. Supervisor oversight further strengthened dependability, as continuous feedback from an experienced academic (with over 40 years of research expertise) provided critical review and guidance throughout the study.

Confirmability was reinforced using an audit trail, which documented all stages of the research process, including data collection, transcription, coding, and interpretation.

Independent coding procedures were applied to minimise researcher bias, with themes derived inductively from the data rather than imposed a priori. The coding process involved multiple readings of transcripts, identification of emerging patterns, and the development of thematic categories, ensuring that the findings were grounded in participants' accounts.

Attention was also paid to translation validity, as most interviews were conducted in Sepedi and later translated into English for analysis. To preserve the authenticity and meaning of participants' responses, careful translation practices were followed, including direct translation, backchecking, and contextual interpretation to avoid loss of nuance. This process ensured that linguistic and cultural meanings were accurately represented in the analysis.

Collectively, these strategies ensured that the study maintained a high level of rigour, producing findings that are credible, dependable, and firmly grounded in participants' lived experiences.

2.9. Ethical Considerations

The study received ethical clearance from the Turfloop Research Ethics Committee (TREC) (Approval Number: TREC/643/2022). Additional permissions were obtained from the Limpopo DoE and the relevant school management teams prior to the data collection. The study adhered strictly to established ethical guidelines for conducting research with human participants, ensuring respect, dignity, and protection from harm throughout the research process.

Several measures were implemented to ensure ethical compliance. First, only learners aged 18 years and older were included in the study, ensuring that participants could legally provide informed consent independently, without the need for parental or guardian permission. The participants were provided with detailed information about the study, including its purpose, procedures, and potential risks, and were informed of their right to withdraw from the study at any stage, without negative consequences (Özden, 2024). This upheld the principle of voluntary participation and autonomy.

Confidentiality and anonymity were rigorously maintained by removing all identifying information from transcripts and reporting, and by using pseudonyms where necessary. Data management procedures were designed to ensure privacy and security, with all research data securely stored and retained for a period of five years (in accordance with institutional and ethical research standards), after which it will be safely destroyed.

In line with feminist methodological principles, particular attention was paid to the use of sensitive, respectful, and non-exploitative language throughout the research process. Feminist ethics emphasises the importance of minimising power imbalances between the researcher and the participants, prioritising participants' voices, and creating a safe and empowering space for them to share their experiences. Accordingly, the researcher adopted an empathetic and reflexive approach during data collection, ensuring that participants were not only protected from harm but also felt valued and heard. This ethical orientation enhanced the integrity of the study and aligned with broader commitments to social justice and inclusivity in educational research.

3. Results

3.1. Demographic Profile

Table 1 provides an overview of the demographic characteristics of the twelve study participants, detailing their age, school location (rural or urban) and school quintile classification. Most participants (nine out of twelve) attended rural schools. Six of them went to a quintile 2 school (a low-income school with limited resources). The other three female learners from rural areas attended a private school, hence the N/A in the quintile column

for participants 7 to 9. In South Africa, private schools do not receive funding from the government; hence, they do not fall under the quintile ranking (Mokhosi, 2023). In contrast, the remaining three participants were enrolled in a quintile 5 urban school, representing a well-resourced public school. Such schools are commonly known as former model-C schools, which Mataboge and Mahlangu (2024) describe as schools serving only the white minority population with high-quality education. Hence, all the facilities needed in a school were available, unlike schools in rural areas (Kanyopa et al., 2024). This demographic distribution underscores disparities in educational environments, which may shape learners' experiences through various factors affecting their academic performance.

Table 1. Demographic profile of the participants.

Participant Identifier	Age	Rural/Urban School	Quintile
P1	18	Rural	2
P2	19	Rural	2
P3	18	Rural	2
P4	18	Rural	2
P5	18	Rural	2
P6	18	Rural	2
P7	19	Rural	N/A
P8	18	Rural	N/A
P9	18	Rural	N/A
P10	18	Urban	5
P11	18	Urban	5
P12	18	Urban	5

Note. N/A: Not Applicable.

3.2. Quotations of Participants

Learner performance in Physical Science varied widely, with some students excelling while others struggled to meet academic expectations. Several factors can influence these outcomes, including personal motivation, career aspirations, and the ability to comprehend and engage with the subject. This theme explores the challenges learners faced in ranking their performance, the role of career ambitions in driving academic effort, and the link between subject comprehension, confidence and motivation.

Sub-theme 1.1: Variability in performance and ranking challenges

Performance levels in Physical Science differ significantly among female learners, making it challenging to establish a clear ranking system. While some students celebrate improvements, others feel discouraged by comparisons with peers.

> Participant 1, with a "sad face", indicated: *"I obtained level one, I am not satisfied with my marks. Some of my classmates laughed at those of us who got level one. They laughed because they got level two and some level three. It is not nice to be laughed at."*

> Participant 4, also with a "sad face", highlighted: *"I obtained level three, and this is unsatisfactory to me. I must obtain level five so that I can pass with a bachelor. Level three is a pass, but it is not a good pass. I do not think I can go to university with level three."*

Sub-theme 1.2: Career aspirations as a motivator for academic performance

Learners recognise the importance of achieving high grades in Physical Science to access competitive career fields such as medicine and engineering.

> Participant 1: *"The career that I have chosen requires a lot of attention on maths and science. And my APS should be better to meet the requirements. My teacher told me that the competition is high and that I should get the best results ever."*

> Participant 8: *"Physical science is fun. It is life. Even the career that I want to do needs science. Even when I was growing up, I enjoyed science. So yeah, I want to be a doctor, so science is something that you need to excel at."*

Sub-theme 1.3: The impact of performance on confidence and motivation

Learners' enjoyment of Physical Science is closely linked to their ability to understand the subject matter. Difficulties with comprehension often lead to frustration and disengagement.

> Participant 4: *"Yes, only if I am enjoying the topic. Because I get irritable if I do not understand in class. I mean, you would also not enjoy if you spent the whole hour listening to something you don't understand, knowing you will have to do homework on it and struggle again tomorrow."*

> Participant 5: *"I only enjoy sometimes. I only enjoy when I understand the topic that is being taught. Because if I don't understand, I am not that open to asking questions."*

> Participant 8: *"Physical science is fun. It is life. Even the career that I want to do needs science. Even when I was growing up, I enjoyed science. So yeah, I want to be a doctor, so science is something that you need to excel at."*

Sub-theme 1.4: The effectiveness of extra classes for academic achievement

Learners express differing views on the impact of extra classes on improving their performance in Physical Science. While some believe that additional lessons provide valuable support, others feel that familiarity with regular teachers reduces the effectiveness of these sessions.

One learner expressed scepticism about extra classes with the same teachers:

> Participant 5: *"I think we need someone that we are not used to. Someone we don't see every day. These ones, ah…we are already used to them. Even if they tell us to do something, we know that if we don't do it, nothing is going to happen to us."*

Conversely, another learner found extra classes beneficial, particularly when the teaching approach was more individualised:

> Participant 12: *"I do view the extra classes as beneficial, particularly for physical science only. I do have a teacher that teaches here at school. I feel like he is more patient, he gives every learner special attention, and if you don't understand anything, he explains."*

Sub-theme 1.5: Homework practices, compliance and challenges

Homework is an essential tool to reinforce learning in Physical Science. However, many learners struggle to complete their assignments due to overwhelming workloads, long school hours, and competing academic demands. While some learners attempt to manage their tasks effectively, others resort to shortcuts to avoid penalties.

One learner admitted to prioritising easier subjects and occasionally copying Physical Science homework from classmates when pressed for time:

> Participant 4: *"I start with other easy subjects first. When I have time, I write maths and science homework. If I don't have time, I don't write them. I will copy them from my friends in the morning."*

Another learner expressed frustration over excessive homework and time constraints:

> Participant 12: *"I feel like homework is exaggerated here at school. Because they expect us to have studying time, we knock off at 5 p.m., and when we get home, we must also rest. At the end of the day, we are scared that missing a homework [stet] will land us in the principal's office."*

Theme 2: The role of support systems in learners' academic success

Support systems, including family, teachers, and peers, play a crucial role in shaping learners' academic experiences in Physical Science. While some students can count on encouragement and academic assistance, others struggle due to household responsibilities, emotional distress, or a lack of support. This theme explores the different ways in which support, or the absence thereof, affects learners' performance, engagement, and confidence.

Sub-theme 2.1: Influence of family, community, and peer support on learning

The presence or absence of academic support from parents, siblings, teachers, and peers significantly affects a learner's success. Some learners are offered encouragement and assistance with their schoolwork, while others face challenges balancing academic demands with household responsibilities.

> Participant 11: *"I am fully supported at home, they only let me do the household chores on weekends, Saturday and Sunday in particular."*

> Participant 12: *"For me, I feel like sometimes maybe I can stop washing dishes and just write. But when I have a lot of work, my mom does help me (smiles). In as much as there can be a lot of schoolwork, I do get help when I need it."*

Sub-theme 2.2: Emotional and psychological impact of limited support

A lack of academic and emotional support from parents and teachers often leads to stress, anxiety, and a decline in academic engagement. Learners who struggle without guidance experience feelings of neglect, negatively affecting their motivation and performance.

> Participant 1: *"When I go to write physical science, I get anxious. I have stress because I don't understand. Last term, I just wanted to abscond while writing my exams, thinking, what is the use? But I eventually came. If my parents were around to help me, it would be better."*

Sub-theme 2.3: Gender-based differences in peer academic support

Some learners perceive differences in the academic support provided by male and female peers, respectively. While collaboration is key to success, certain learners feel that male classmates are more willing to offer help without hesitation or competition than their female counterparts.

> Participant 6: *"I usually get assistance from boys. Those ones are not jealous; they help you with all their hearts. But girls—iyhooo! I would rather ask for help from boys only."*

> Participant 3: *"I prefer boys to help me with calculations for Physical Science because they are more patient with me"*

Theme 3: Barriers to academic success in Physical Science

Learners face multiple challenges that hinder their academic success in Physical Science. These barriers range from household responsibilities and family conflicts to institutional shortcomings and psychological stress. The inability to balance their academic demands with personal struggles often results in emotional distress, reduced focus, and declining performance. This theme explores the obstacles that affect learners' ability to excel in Physical Science—and the need for targeted interventions to support them.

Sub-theme 3.1: Household responsibilities and academic disruptions

Learners struggle to balance schoolwork with excessive household responsibilities, which limit their study time and their overall academic engagement. Female learners, in particular, report that chores interfere with their ability to focus on school tasks. Once they get home, their minds are occupied with household chores, which often replace schoolwork that needs to be completed.

> Participant 2: *"They should stop giving me too many chores and stop suffocating me. When I get home, they should stop telling me to wash the dishes and cook when I have too much schoolwork."*

> Participant 7: *My mom is always at home but she waits for us to come back from school and do the chores. If only she could do at least half of them, it will be better for me. I will have enough time to write my homework.*

> Participant 10. *"When I come back from school, they want me to fetch my little brother from pre school. And that takes too much time because I walk there. I don't know why they don't send my uncle because he is always at home".*

Sub-theme 3.2: Family conflicts and their impact on learning

Unstable home environments, particularly those marked by parental conflict, create emotional distress that undermines academic focus and motivation. Learners often find it difficult to concentrate on schoolwork when dealing with stress at home. The events that happen at home often replay themselves in learners' minds in class.

> Participant 11: *"It breaks me when my parents fight and ignore me and my schoolwork. I feel like the attention they are giving to their silly fights should be directed to me and my siblings."*

The results presented revealed the diverse experiences of female learners in Physical Science across different school contexts. The findings highlighted variations in academic performance, learners' aspirations, confidence levels, study practices and perceptions of academic support. The results also illustrate the importance of family, teacher, and peer support in shaping learners' educational experiences, while simultaneously revealing challenges associated with limited support. Furthermore, several barriers to academic success were identified, including household responsibilities, family-related challenges, and academic pressure. Overall, the presentation of results demonstrated the multifaceted factors influencing female learners' experiences and performance in Physical Science.

4. Discussion

The aim of this study was to establish the factors influencing the performance of female Physical Science learners in Limpopo Province and to understand how these learners experience and manage challenges in the subject. The findings indicate that female learners' experiences were primarily shaped by performance pressure, their understanding of Physical Science content, participation in extra classes, homework demands, support from family and peers, household responsibilities, and emotional stress. These factors interacted in

complex ways to influence both learner's engagement with the subject and their academic performance. One of the most prominent findings was the pressure learners experienced in relation to performing well in Physical Science. Participants reported comparing their academic performance with that of their peers, particularly high-achieving learners. While some learners viewed these comparisons as motivating, others experienced feelings of self-doubt and academic inferiority when they perceived themselves as underperforming. These findings support previous research suggesting that performance comparisons can have both positive and negative effects on learner motivation, with some learners excelling while others struggle (Fong et al., 2024). However, the findings of this study further suggest that female learners' experience of performance pressure is shaped by gendered expectations that often position males as naturally more capable in science-related subjects. From a feminist science perspective, such perceptions may contribute to reduced confidence among female learners even when they demonstrate academic competence (Shibley Hyde & Kling, 2001).

Another important finding relates to learners' understanding of Physical Science content. Participants described certain topics as difficult and reported challenges in grasping complex concepts, particularly when classroom explanations were insufficient. Learners who experienced difficulties in understanding the content often reported lower confidence and increased anxiety about assessments. In contrast, learners who received additional academic support from teachers, peers, or family members appeared more confident and engaged in the subject. These findings support Bandura's (2015) argument that learners' confidence in their academic abilities is strengthened through positive learning experiences and appropriate support.

Career aspirations also emerged as a significant motivational factor. Several participants indicated that success in Physical Science was important because it was linked to their future career goals, including professions in science, engineering, and healthcare. These aspirations motivated learners to persevere despite the challenges they encountered. This finding suggests that future-oriented goals can strengthen learners' commitment to science education and may serve as an important protective factor against academic discouragement. However, the findings also indicate that learners' ambitions may be constrained by structural barriers, including limited educational resources and restricted access to career guidance, particularly in rural schools.

The findings further highlight that competence and autonomy, as emphasized by self-determination theory (Trenshaw et al., 2016) are not equally achievable for all learners, particularly those in rural contexts. Participants from rural schools consistently described challenges associated with inadequate resources, overcrowded classrooms, and limited access to academic support. These barriers affected both their understanding of Physical Science and their ability to perform well academically. Rurality therefore emerges as a structural factor that intensifies educational inequality. The findings suggest that female learners face a dual challenge navigating the disadvantages associated with under-resourced schools while also contending with gendered expectations within their communities and households.

The findings regarding extra classes revealed mixed experiences among participants, while some learners regarded extra classes as valuable opportunities to improve their understanding of physical science content and prepare for examinations, others reported that these classes were not always effective in addressing their learning needs. Participants indicated that the benefits of extra classes depended largely on the quality of instruction and the extent to which teaching approaches supported learner participation and understanding. These findings suggested that additional instructional time alone may not improve performance unless it is accompanied by learner-centered pedagogical practices.

Similarly, homework emerged as both a learning support strategy and a source of frustration. Some learners viewed homework positively because it allowed them to reinforce classroom learning and identify areas requiring further attention. However, other participants reported difficulties completing homework because of limited parental support, inadequate study spaces, and competing household responsibilities. In some cases, learners admitted to copying homework because they lacked sufficient time or support to complete tasks independently. These findings reveal how socioeconomic conditions influence the effectiveness of homework and highlight the uneven opportunities available to learners outside the classroom (Brenner, 2022).

Family support was identified as a critical factor influencing learners' experiences and performance in Physical Science. Participants who received encouragement, assistance, and emotional support from parents or guardians reported greater motivation and confidence. In contrast, learners from unstable family environments described experiencing emotional distress, reduced concentration, and diminished academic motivation. These findings are consistent with previous studies showing that family dynamics significantly influence learners' educational outcomes (Deng et al., 2022). Peer support also played an important role in female learners' academic success in Physical Science. Participants described how studying with friends, discussing difficult concepts, and receiving encouragement from classmates helped them manage academic challenges. Positive peer relationships contributed to a sense of belonging and confidence, while the absence of supportive peer networks sometimes increased feelings of isolation and academic uncertainty. These findings emphasise the social nature of learning and suggest that collaborative learning opportunities may enhance engagement and performance in Physical Science.

Importantly, the study underscores how patriarchy operates within households to influence educational outcomes. A recurring finding was that some female learners were responsible for substantial household chores after school. Participants explained that responsibilities such as cooking, cleaning, caring for younger siblings, and other domestic duties reduced the time available for studying and completing homework. Feminist scholarship argues that the gender division of labour systematically disadvantages girls by assigning them disproportionate domestic responsibilities (Kyei-Gyamfi, 2025). The findings of this study support this view by demonstrating how household responsibilities directly affect female learners' ability to focus on their studies and engage fully with Physical Science learning activities.

Emotional stress emerged as another significant finding. Participants described experiencing stress related to academic performance, examination expectations, family problems, and balancing schoolwork with domestic responsibilities. The cumulative effect of these pressures often affected learners' concentration, confidence, and motivation. Research on academic stress suggests that prolonged exposure to such pressures can result in anxiety, disengagement, and reduced academic performance (Kruger et al., 2018). The findings therefore indicate that emotional well-being is closely linked to academic success and should receive greater attention within school support systems.

Overall, the findings demonstrate that female learners' performance in Physical Science is not solely determined by individual ability or effort but by a combination of academic, social, familial, and structural factors. Participants' experiences reveal that performance pressure, understanding of subject content, career aspirations, extra classes, homework demands, family support, peer relationships, household responsibilities, and emotional stress collectively shape their engagement with Physical Science. While FST provides a useful lens for understanding how gendered expectations and patriarchal structures influence these experiences, the findings emphasise that female learners' challenges are embedded in their everyday realities and lived experiences.

The findings further reveal important opportunities for intervention. Schools should strengthen academic support programs, provide career guidance opportunities, encourage peer collaboration, and establish support mechanisms that promote learners' emotional well-being. Greater family involvement and efforts to challenge gendered household expectations are also necessary to ensure that female learners have adequate opportunities to participate fully in Physical Science education. By foregrounding the lived experiences of female learners, this study contributes to a more nuanced understanding of gender equity in STEM education and highlights the importance of creating supportive, inclusive, and resource-rich learning environments that promote both academic success and personal development.

The limitations of the study include permission not being granted to conduct research at some of the elite private schools in the urban area. Additionally, the sample size was small because data saturation was reached at the fourth school. No new knowledge emerged from the last interview conducted. Although the sample size is consistent with phenomenological research, which prioritises depth of understanding over breadth, the findings are context-specific and are based on the experiences of twelve female learners from four schools within a single district in the Limpopo province. The study further relied on self-reported interview data, which may have been influenced by participants' personal perceptions, memory recall, and willingness to disclose sensitive information. As with all qualitative research, participants' accounts reflect their subjective interpretations of their experiences and may not capture all dimensions of the phenomenon under investigation. Another limitation relates to the translation of interview data from Sepedi into English. Although the researcher is a native speaker and took care to preserve the original meanings, cultural nuances, expressions, and contextual meanings may have been partially lost or altered during the translation process.

Furthermore, as the researcher was responsible for data collection, translation, coding, and interpretation, researcher positionality may have influenced the analysis of the findings. While reflexive practices, independent coding, and consensus discussions were employed to enhance trustworthiness, it is acknowledged that the researcher's experiences, assumptions, and theoretical orientation may have shaped the interpretation of participants' narratives. However, the researcher allowed female learners to express their opinions without a secondary party present and examined the holistic factors that affect their experiences. Despite these limitations, the study provides rich, contextually grounded insights into the lived experiences of female learners in Physical Science and contributes to understanding the gendered, social, and structural factors that influence their academic experiences.

For future studies, researchers may focus on factors affecting female learners' performance in mathematics, as explored through their own experiences. Both male and female students need an inclusive environment for learning STEM subjects. Moreover, more females should be retained in STEM. Letsoalo (2017) emphasises that Mathematics and Physical Science are integral to pursuing a qualification in STEM after matriculation in South Africa. Simelane (2019) agrees that Mathematics is a requirement for learners to enrol in Physical Science studies.

5. Conclusions

This study makes a significant contribution to feminist STEM scholarship by showing how the academic performance of female Physical Science learners in the Limpopo province is influenced not only by individual motivation and support systems, but also by broader gendered power relations, structural inequalities, and patriarchal norms. While career aspirations, self-determination, and access to support structures, including extra classes and parental involvement, were found to enhance motivation and engagement, the findings demonstrate that these enabling factors operate within unequal social contexts. Female

learners' experiences are constrained by systemic barriers, including disproportionate household responsibilities, family instability, and psychological stress, all of which reflect deeply embedded gender inequalities that continue to disadvantage them in STEM education.

By focusing on the lived experiences of female learners, this study moves beyond deficit-based explanations of performance to highlight how factors such as rurality, socio-economic status and patriarchy influence educational outcomes. In doing so, it advances feminist understandings of education by emphasising the need to transform institutional practices and societal norms that reproduce gender inequities. The findings underscore that achieving gender equity in STEM requires more than increasing access; it necessitates inclusive and supportive learning environments that actively challenge gendered expectations and redistribute opportunities more equitably.

From a policy perspective, the study calls for the development and implementation of gender-responsive educational strategies aimed at overcoming both academic and socio-cultural barriers. These include targeted interventions such as structured academic support programmes such as remedial teaching, peer-assisted learning, and personalised tutoring, particularly in under-resourced and rural schools. Equally important are policies to reduce the burden of unpaid domestic labour on female learners through community awareness and parental engagement initiatives. Schools must also play a proactive role in boosting learners' emotional well-being by enhancing counselling services, mentorship programmes, and safe spaces that foster resilience and a sense of belonging.

Ultimately, this study highlights that sustainable improvements in female learners' participation and success in Physical Science depend on a holistic, gender-responsive approach that integrates educational reform with broader social change. By tackling structural barriers, promoting equity-driven policies, and embedding feminist principles within STEM education, stakeholders can create environments in which female learners are not only included, but are empowered to thrive and excel.

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References

Banchefsky, S., & Park, B. (2018). Negative gender ideologies and gender-science stereotypes are more pervasive in male-dominated academic disciplines. *Social Sciences*, *7*(2), 27. [CrossRef]

Bandura, A. (2015). Self-efficacy conception of anxiety. In *Anxiety and self-focused attention* (pp. 89–110). Routledge.

Berardi, A., & Morton, B. M. (2017). Maximizing academic success for foster care students: A trauma-informed approach. *Journal of At-Risk Issues*, *20*(1), 10–16.

Bluhm, R., Maibom, H. L., & Jacobson, A. J. (2012). *Neurofeminism: Issues at the intersection of feminist theory and cognitive science*. Springer.

Brenner, C. A. (2022). Self-regulated learning, self-determination theory and teacher candidates' development of competency-based teaching practices. *Smart Learning Environments*, *9*(1), 3. [CrossRef]

Chakawodza, J. M. (2018). *A critical investigation of curriculum delivery practices in schools: A case of girls' performance in physical sciences in South African schools*. University of Johannesburg (South Africa).

Charlesworth, T. E., & Banaji, M. R. (2019). Gender in science, technology, engineering, and mathematics: Issues, causes, solutions. *Journal of Neuroscience*, *39*(37), 7228–7243. [CrossRef]

Collins, M. A., Romero, V. F., Young, A., Dorph, R., Foreman, J., Strang, C., & Laina, V. (2025). The value of outdoor environmental education programs for girls and youth of color: Cultivating positive dispositions toward science and the environment. *Environmental Education Research*, *31*(1), 108–133. [CrossRef]

Creswell, J. W., & Creswell, J. D. (2017). *Research design: Qualitative, quantitative, and mixed methods approaches*. Sage Publications.

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

Crossley, M. (2009). Rethinking context in comparative education. In *International handbook of comparative education* (pp. 1173–1187). Springer Netherlands.

Deng, Y., Cherian, J., Khan, N. U. N., Kumari, K., Sial, M. S., Comite, U., & Popp, J. (2022). Family and academic stress and their impact on students' depression level and academic performance. *Frontiers in Psychiatry*, *13*, 869337. [CrossRef]

Fernandez, L. (2023). Unveiling gender dynamics: An in-depth analysis of gender realities. *Influence: International Journal of Science Review*, *5*(3), 61–70. [CrossRef]

Fong, C. J., Altan, S., Gonzales, C., Kirmizi, M., Adelugba, S. F., & Kim, Y. E. (2024). Stay motivated and carry on: A meta-analytic investigation of motivational regulation strategies and academic achievement, motivation, and self-regulation correlates. *Journal of Educational Psychology*, *116*(6), 997. [CrossRef]

Fussy, D. S., Iddy, H., Amani, J., & Mkimbili, S. T. (2023). Girls' participation in science education: Structural limitations and sustainable alternatives. *International Journal of Science Education*, *45*(14), 1141–1161. [CrossRef]

Harding, N. (2023). Locating our research within feminist philosophies and epistemologies. In *Handbook of feminist research methodologies in management and organization studies* (pp. 91–105). Edward Elgar Publishing.

Kanyopa, T. J., Hlalele, D. J., & Mokhele-Makgalwa, M. (2024). The implementation of learner integration and its challenges in a selected former Model C school: Learners' perspectives. *South African Journal of Education*, *44*(3), 1–11. [CrossRef]

Kibirige, I., & Modjadji, S. E. (2022). Grade 10 girls' experiences in choosing STEM subjects in Rakwadu Circuit, South Africa. In *Advances in research in STEM education*. IntechOpen.

Kim, A. Y., Sinatra, G. M., & Seyranian, V. (2018). Developing a STEM identity among young women: A social identity perspective. *Review of Educational Research*, *88*(4), 589–625. [CrossRef]

Kruger, L. J., Wandle, C., & Struzziero, J. (2018). Coping with the stress of high stakes testing. *High Stakes Testing*, *23*(2), 109–128. [CrossRef]

Kvale, S., & Brinkmann, S. (2009). *Interviews: Learning the craft of qualitative research interviewing*. Sage.

Kyei-Gyamfi, S. (2025). Household chores and their effects on children: Perspective from Ghana. *Humanities and Social Sciences Communications*, *12*(1), 1–9. [CrossRef]

Leaper, C., & Starr, C. R. (2019). Helping and hindering undergraduate women's STEM motivation: Experiences with STEM encouragement, STEM-related gender bias, and sexual harassment. *Psychology of Women Quarterly*, *43*(2), 165–183. [CrossRef]

Letsoalo, M. E. (2017). The effect of mathematics and physical science on matriculants' overall performances: Analysis using multilevel model. *Journal of Education and Vocational Research*, *8*(4), 28–42. [CrossRef]

Limpopo Department of Education. (2026). *STATISTICS*. Available online: https://www.edu.limpopo.gov.za/ (accessed on 15 August 2026).

MacGregor, R. G., & Ross, A. J. (2025). Performance of grade 12 rural origin health science students supported by the Umthombo Youth Development Foundation. *African Journal of Health Professions Education*, *17*(3), 2–7.

Mataboge, S. K., & Mahlangu, V. P. (2024). Exploring the prevalence of racism in former model c schools in South Africa: From a social justice perspective. *Social Sciences and Education Research Review*, *11*(2), 115–123.

Mathibela, P., & Masinire, A. (2024). Navigating gender roles and expectations in physical science: A decolonial study of grade 10 girls' experiences in a rural school in South Africa. In *ICERI2024 proceedings* (pp. 10014–10019). IATED.

Middleton, R. (2024). *Stronger together: The intersection between Sandra Harding and informal science education* [Honors thesis, The University of Southern Mississippi].

Mokhosi, B. (2023). *A comparative study: Investigating the impact of a non-government philanthropic primary school versus quintile one government primary schools in the provision of equitable and quality education in marginalized communities in KwaZulu-Natal, South Africa*. Available online: https://www.unicafuniversity.ac.zm/thesis-publications/a-comparative-study-investigating-the-impact-of-a-non-government-philanthropic-primary-school-versus-quintile-one-government-primary-schools-in-the-provision-of-equitable-and-quality-education-in-ma/ (accessed on 10 August 2026).

Naidoo, J., & Sibanda, D. (2020). Examining science performance of South African grade 9 learners in TIMSS 2015 through a gender lens. *South African Journal of Education*, *40*(2), S1–S10. [CrossRef]

Naugah, J., & Watts, M. (2013). Girls and science education in Mauritius: A study of science class practices and their effects on girls. *Research in Science & Technological Education*, *31*(3), 252–268. [CrossRef]

Olatunde-Aiyedun, T. G., Chakraborty, T., & Mishra, N. (2024). Women in science education in the 21st century with special reference to Nigeria. In *Gender equality: An international perspective* (pp. 57–73). Nova Science Publishers.

Özden, M. (2024). Active participation or legal obligation? A qualitative study of the effectiveness of participatory methods designed for local participation: M. Özden. *Quality & Quantity*, *58*(1), 559–580. [CrossRef]

Prayogi, S., & Verawati, N. N. S. P. (2024). Physics learning technology for sustainable development goals (SDGs): A literature study. *International Journal of Ethnoscience and Technology in Education*, *1*(2), 155–191. [CrossRef]

Shibley Hyde, J., & Kling, K. C. (2001). Women, motivation, and achievement. *Psychology of Women Quarterly*, *25*(4), 364–378. [CrossRef]

Simelane, T. T. (2019). *Barriers to high performance in physical science among learners: A case of selected township secondary schools in South Africa*. University of South Africa (South Africa).

Sithole, A., Chiyaka, E. T., McCarthy, P., Mupinga, D. M., Bucklein, B. K., & Kibirige, J. (2017). Student attraction, persistence and retention in STEM programs: Successes and continuing challenges. *Higher Education Studies*, *7*(1), 46–59. [CrossRef]

Stoet, G., & Geary, D. C. (2018). The gender-equality paradox in science, technology, engineering, and mathematics education. *Psychological Science*, *29*(4), 581–593. [CrossRef]

Temple, B., & Young, A. (2004). Qualitative research and translation dilemmas. *Qualitative Research*, *4*(2), 161–178. [CrossRef]

Trenshaw, K. F., Revelo, R. A., Earl, K. A., & Herman, G. L. (2016). Using self-determination theory principles to promote engineering students' intrinsic motivation to learn. *International Journal of Engineering Education*, *32*(3), 1194–1207.

Tufford, L., & Newman, P. (2012). Bracketing in qualitative research. *Qualitative Social Work*, *11*(1), 80–96. [CrossRef]

Vansoeterstede, A., Cappe, E., Ridremont, D., & Boujut, E. (2024). School burnout and schoolwork engagement profiles among French high school students: Associations with perceived academic stress and social support. *Journal of Research on Adolescence*, *34*(3), 969–986. [CrossRef]

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