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# Teachers' Perceptions about the Quality of Teaching and Learning of Science Education in the Disadvantaged Primary Schools in the North-West Province, South Africa

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## Abstract

**Background:** This research explores teachers' perceptions of the quality of teaching-learning of science education in primary schools. Employing qualitative approach that involves primary teachers in Dr. Kaunda district in Northwest Province. **Aims:** The aim of this study was to investigate the perceptions of teachers on the quality of teaching and learning of science education in primary schools. **Location:** The research study was conducted in four (4) primary schools in the North-West province in South Africa. Eight (8) science education teachers participated and were purposively selected in the study. **Method:** A qualitative approach and case study design were employed. Data were collected through semi-structured interviews to develop an understanding of teachers' perceptions of quality teaching and learning of science education at the primary school level. **Conclusions:** The findings of this study highlight the following: poor teaching methods used, they do not employ a variety of teaching methods during instructional time to meet the needs of diverse learners, poor lesson preparation and proper planning, teachers' qualification is one of most important effective component for the delivery of lessons and planning in the classroom environment, they do not proper lesson preparation and planning, inadequate science equipment or laboratories which can impede the quality of teaching and learning, underqualified teachers, lack of content and pedagogical knowledge, poor infrastructure, and learning environment, curriculum implementation challenges. Recommendations have also been made on how best teachers can foster and improve the quality of teaching and learning of science education in schools.

## Keywords

Primary Schools, Quality Teaching, Science Education, Teachers, Perceptions

## 1. Introduction

Science education has won unprecedented consideration as one of the keys to national strength and tool to address the economic, social and environmental challenges (Cortes et al., 2024). Therefore, teachers' perceptions about the quality teaching and learning of science education in primary schools have received substantial consideration in recent years (Garraway-Lashley, 2019). However, scholars, researchers, teachers, and policy makers voice a growing concern at the decreasing interest of learners in scientific careers (Lepholletse, 2001; NRF, 2001). These concerns are strengthened by the research, which demonstrates the ignorance of the public (Bantwini, 2017). Nowadays, learners require prospects of developing a disposition towards learning and teaching that will invest them, through their entire life, to become proactive explorers of knowledge and lifelong learners who keep pace with and inform the process of change (Watters & Ginns, 2000). However, the key that can assist this process to happen lies with teachers who model preparedness for learning and a display of personal assertion in science education learning. According to the National Research Council (NRC) (2012), high-quality science education teaching and learning at the primary school level is fundamental for the learners' success and advancement in life.

Commitment to science education at the primary school level may act as a catalyst in developing the learners' interest in science in the future (James et al., 2019; Garraway-Lashley, 2019). According to James et al. (2019), doing so may supply the learners with the opportunity to expand their inherent curiosity about the natural world and to enable the acquisition of knowledge, skills, and values which form the basis of their future learning (Saçkes et al., 2010). Therefore, the quality teaching and learning of science education is fundamental in the early years of schooling because it allows learners to build a fundamental understanding of science in time. On the other hand, Delmoro (2022), Obaydullah (2019), Smith and Fitzgerald (2016) assert that the quality of the teaching-learning of science education plays a significant role in achieving the overall quality of education. Science education has an important role to play in the development of critical and informed citizens in a rapidly technological society (Watters & Ginns, 2000).

According to Lepholletse (2001) and the *National Research Foundation* (NRF) (2001), the teaching and learning of science education in schools, particularly the secondary school level, has received priority consideration internationally. Its role has received recognition in the country's societal development (Bantwini, 2017; Ngema, 2016; Kibet et al., 2012; NRF, 2001). Regardless of the countless countries' considerations of science education, in South Africa, such considerations have not been many (Bantwini, 2017). Research has indicated that, as an integral component of today's world, effective teaching and learning of science and technology at the primary level can have a substantial impact on all aspects of human existence.

## 2. Literature Review

The consideration of quality teaching and learning of science education in primary schools appears to be a widespread trend not only in South Africa but in the international world (Garraway-Lashley, 2019; National Research Council, 2012). These considerations appear necessary because many teachers in primary schools globally tend to be reluctant towards teaching science, partly because they are not confident enough in science, and partly because of their limited science background. As a result, the state of science education in primary schools appears to be a sweltering concern in most schools due to the teachers and learners' high rate of poor performance (Smith & Fitzgerald, 2016; Hacieminoglu, 2014). This poses a serious distress for primary schools in developed and developing countries due to their immense contribution to the socio-economic development (Hacieminoglu, 2014). Therefore, the crucial point about science education on the work of teachers and the predicaments involved in deciding what learning matters for the learners and how their professional practice nurtures this learning plays an important role (Smith & Fitzgerald, 2016).

Science education has been recognised as a dynamic and significant factor in the teaching and learning process (Vreken, 1996 in Lepholletse, 2001). Therefore, the quality of teaching and learning of science education must start at primary school level to expose the learners to the fulfilment of the ultimate aims as well as to prepare them for active participation in their future (Eltanahy & Forawi, 2019). In addition, the objective of science education is to prepare future scientists and to educate primary school learners so that they can become scientifically literate (Eltanahy & Forawi, 2019). Primary school level is the time when learners begins to build a fundamental understanding of science. On the other hand, Eshach & Fried (2005) maintain that early science learning may enhance the learners' curiosity, the understanding of the natural world and appreciation. These are the central issues because of their significant role in the development of critical and informed citizens in a rapidly technological society. Young children naturally enjoy observing and thinking about nature. Science is the systemic study of the structure and behaviour of the social, physical, and natural worlds through observation and experiment (Mickens & Patterson, 2016). The provision of quality teaching-learning of science education in primary schools may bring a positive effect on the future of every learner. According to the *International Council for Science* (2011) and Bantwini (2017), stimulating science education is viewed as fundamental for both the future of science and the ongoing development of the global knowledge society.

Science education in the South African context is full of problems, which include internationally poor comparison (Ngema, 2016; Muzah, 2011; Lepholletse, 2001; NRF, 2001) and decreasing learner enrolment at tertiary education institutions (Hacieminoglu, 2014; NRF, 2001) due to the high failure rate of learners, specifically in science education, which continues to pose threats in South Africa's economy and development. According to Reddy et al. (2016) and Bantwini (2017),

South Africa has been persistently ranked among the lowest-performing countries in the science subjects. This is the outcome of the failure by the South African government to put limited emphasis on the quality teaching of science education at the primary school level. Primary school teacher professional development has been greatly ignored by the Department of Basic Education (DBE) in South Africa, while more consideration is put on secondary science teachers. This is a worrisome situation whereby the learners' attitude and interest in science have declined. This decline of interest in science indicates some challenges to the achievement of quality basic education.

Remarkable evidence is that a sound foundation in science education, especially at primary school level may, perhaps increase the learners' interest and continuity in studying science, thereby increasing the pool of learners who can pursue science education at tertiary school level. This may ultimately reduce the country's skills shortage (Bantwini, 2017). Watters and Ginns (2000), on the other hand, allude to the fact that the advantage of making science education meaningful and useful for the modern world is to:

> ...create the understanding and habits of the mind that are required to become compassionate human beings who can reflect on themselves and face life head on. It should prepare them to engage in informed dialogue with fellow citizens. in creating and sustaining an open, decent, and thriving society (Watters & Ginns, 2000).

According to Bantwini (2017) and the National Research Council (NRC) (2012), the quality of teaching and learning science in primary schools plays an important role in the success and advancement of the overall quality education. On the other hand, Anderson & Helms (2001) maintain that some of the problems with science education are that the changes called for and difficult to put into practice create dilemmas for teachers, and require significant changes in teachers' values, beliefs and the teaching and learning practices. At the centre of making science education meaningful for learners are the accomplishments and ingenuity of classroom teachers. Therefore, teachers must be skilful in responding effectively not only to societal expectations but also to the changing nature of their profession (Watters & Ginns, 2000). However, it is now recognised that the number of learners with adequate and sound knowledge, attitude and skills in maths and science needs to increase as this will increase the number of matriculants who move into higher education, business and industry (The Teacher, 2001).

Regardless of the above consensus, Garraway-Lashley (2019) recommends that teaching and learning are what ultimately make a difference in the mind of the learner. They affect knowledge, skills, attitudes, and the capacity of young people to contribute to contemporary societies. Teaching becomes the centre stage of science learning and the learners' achievement (Bantwini, 2017). Therefore, globally teachers are recognised as critical drivers in the delivery of quality education in science and technology at whatever level (Kalu, 2012). The accomplishments of

the educational aspiration of any country depend fundamentally on the contributions made by its teachers. Watters and Ginns (2000) remarkably mentioned that the advantage of making science education meaningful and useful for the modern world is to:

"...create the understanding and habits of the mind that are required to become compassionate human beings who can reflect on themselves and face life head on". It is against this background becomes clear that quality teaching-learning of science education requires critical consideration, especially at primary school level.

The issue and the complexity of teaching and learning science education in the developed countries have received great consideration due to the envisaged returns (Osborne & Dillon, 2008). For example, in the US, the National Commission on Mathematics and Science Teaching, as regulated by Glenn (2000) for the 21st century, disputed that the future well-being of their nation and people depended not only on how well they educate their children in the main but also on how they educate their children in mathematics and science. Hence, in the developing countries of the Suh-Saharan Africa, such as Kenya, Nigeria, South Africa, and Zimbabwe research revealed that learners still fall behind as compared to the learners in other nations concerning maths and science performance and achievement (Leornardi et al., 2019; Mwangu & Sibanda, 2017; Mupa & Chinooneka, 2015). Nevertheless, the Teaching and Learning Research Programme (TLRP) (2006) in the UK reports on science education in schools, posits that the ability to generate knowledge and to use it innovatively depends upon having a scientifically literate population and quality science education in schools is an important preparation for scientific literacy in later life.

To date, most research studies have addressed secondary schooling, although research into primary school science education identifies similar issues and is referred to where available (Kaptan & Timurlenk, 2012). Furthermore, Kaptan and Timurlenk (2012) argue that, if the primary goal of science education is to increase the flow of specialist scientists, technologists, and engineers, it may be debatable whether young people with special talent in science at the primary school level should be identified as early as possible and given separate, specialized, and highly focused science education. According to Chalufour (2010), the quality teaching of science may develop the learners' academic performance. On the other hand, Müller et al. (2016) are of the opinion that for the science teachers with high-quality classroom level processes to develop the learners' scientific competencies systematically, educational experiences in school are crucial. Therefore, the strength of any education system depends largely on the quality of teachers. They are the cornerstone of educational quality, and they play a central role in the learners' academic performance and achievement. Teachers are viewed as central to education.

## 3. The Purpose of This Study

To investigate the teachers' perceptions of the quality of teaching-learning of science in primary schools.

To identify the teaching-learning strategies that are suitable for science teaching.

To determine the factors that hinder the quality teaching of science education in primary schools.

To draw recommendations for policy and practice on the teaching and learning of science education in a Southern rural context

## 4. Research Questions

What are the teachers' perceptions of quality teaching and learning of science education in the primary schools?

Which teaching and learning strategies are suitable for quality teaching and learning of science education in schools?

What factors hinder the quality of science education teaching and learning in primary schools?

What recommendations can be drawn for policy and practice on the teaching and learning of science education in a Southern rural context?

## 5. Definition of Quality Teaching and Learning of Science

Various scholars have defined the quality of teaching and learning of science as follows:

The quality teaching and learning of science refers to an effective, learner-centred teaching process in which teachers apply appropriate pedagogical strategies, resources, and assessment methods to develop learners' scientific knowledge, skills, values, and attitudes (Twizeyimana et al., 2024). Furthermore, quality teaching and learning science involves engaging learners actively in inquiry, critical thinking, problem solving, and practical investigations, while connecting scientific concepts to real-life context (Shahat et al., 2025; Kersting et al., 2023). According to Halfon (2025) and Choycawen et al. (2024), the quality of teaching and science learning underscores teachers' capability to present content accurately and meaningfully, familiarise learners' needs, and to create an inclusive and supportive learning atmosphere. On the other hand, James et al. (2019), Smith and Fitzgerald (2016) alleged that the quality in science teaching is the reflection in learners' deep understanding of scientific concepts, their ability to apply knowledge in everyday situations, and their development of curiosity and a positive attitude toward science.

## 6. Theoretical Framework

The theoretical approach used in this study is based on a study by Bandura (1997). This idea was guided by Bandura's Self-Efficacy idea, which is part of Social Cognitive Theory. According to Bandura (1997), self-efficacy is the belief in one's ability to organise and carry out the sense of action required to manage upcoming problems. It is what a person believes he or she can do with his or her skills under specific conditions (Garraway-Lashley, 2019). Self-efficacy beliefs include two op-

tions: personal scientific teaching self-efficacy (PSTE), which considers a teacher's conviction that teaching science effectively affects student achievement, and scientific Teaching Outcomes Expectancy (STOE). The latter refers to teachers' assumptions that pupils can acquire science, given certain external conditions.

To effectively implement the science education curriculum at the primary school level, teachers must have confidence in their scientific knowledge as well as their ability to select and use innovative and active teaching practices (Oyelekan et al., 2017). Furthermore, Umke and Nwafor (2014) claimed that the implementation of innovative teaching approaches can promote self-motivation and independent learning rather than simply transmitting information and norms. As a result, educational techniques, pedagogical content knowledge, and subject understanding among science teachers must be seen as concerning and significant elements in science education.

### 6.1. This Part Introduces the Analytical Framework, Which Identifies the Elements That Inhibit Quality Teaching-Learning in Science Education in the Classroom

Education is a critical part in any country's growth, and it is heavily influenced by teacher quality (Brainard, 2010; Kumar, 2023). As a result, topic understanding, pedagogical content knowledge, quality, dedication, professional commitment, and teacher motivation are the primary drivers of quality instruction and student achievement in schools. Several research studies, according to Ogbu (2015) and Brainard (2010), have identified the elements that contribute to poor-quality scientific teaching and learning in elementary school. They include the following:

### 6.2. Inadequate Scientific Equipment and Apparatus

Quality teaching requires quality, enough learning resources, and continual professional growth throughout the teacher's career (Ogbu, 2015). Quality tools refer to the utilization of teaching and learning materials and resources, as well as the associated training in effective pedagogy (Brainard, 2010). Inadequate use of educational materials and facilities affects teachers' motivation to educate. According to Ogbu (2015), when teachers are given enough instructional resources to address their concerns, they feel more enthusiastic and motivated. Their sense of ownership and empowerment grows. The availability of suitable learning materials in every school motivates teachers to go the extra mile and teach confidently.

### 6.3. Inappropriate Application of Instructional Methodologies

According to Oyelekan et al. (2017), attempts have been made to improve the quality of science teaching and learning in elementary schools, yet students continue to do badly in science education. When teachers adopt creative teaching tactics, it stimulates learners' interest and motivation to study and has a substantial impact on learners' academic progress. However, the employment of incorrect teaching tactics during classroom engagement may result in learners losing inter-

est and acquiring negative attitudes toward the subject.

### 6.4. Poor Lessons Preparation and Planning

To make a lesson a success, teachers must implement a variety of teaching and learning activities throughout the lesson and properly plan ahead of time (Vreken, 2001; Lepholletse, 2008). However, lesson preparation and planning are critical components of the teaching process. The quality of teaching and learning is heavily influenced by lesson planning prior to class. According to Vreken (2001), before preparing and organising a lesson, the instructor must identify who the lesson is intended for, what learning content will be taught, and what the lesson will accomplish. Lesson planning influences the success of the lesson presentation, whereas planning provides direction (Frazer et al., 1991).

### 6.5. Poor Teaching Strategies Use in Science Education

Classrooms are viewed as multidimensional units including multiple aspects that have a substantial impact on learners' progress (Zahid & Nawab, 2025). However, among these elements, teacher quality has repeatedly been identified as a critical determinant in predicting learning quality, and thus learner accomplishment (Darling-Hammond, 2000). According to Hattie (2008), the quality of the learning is strongly dependent on the instructional tactics they employ. Zahid and Nawab (2025) also claimed that a common issue with teaching strategies identified through research is the tendency to focus on teaching learners "what" to study, with a focus on learning outcomes, while ignoring the critical aspect of teaching them "how" (Zahid & Nawab, 2025).

### 6.6. Lack of Subject Matter

According to Kind's (2009) research study, the emphasis on content understanding was placed on primary science teachers, who were discovered to have misconceptions about several science issues. Furthermore, Kind said that weak topic matter understanding relates to teachers' low self-confidence in teaching science, resulting in poor-quality sessions at the primary level. According to Seherrie and Mawela (2022), SCK refers to a teacher's acquired and developed knowledge within their field of specialty. It is claimed that teachers with broad and deep topic knowledge, awareness of common alternative notions, and a scientific model can provide rich and adaptable knowledge of the subject they teach (Kind, 2009). To respond to the needs and problems of their students, they must have extensive topic knowledge. However, additional direction from professional development programs can boost the self-confidence of scientific teachers. Jarrett (1998), on the other hand, observes that teachers' earlier experiences teaching school science have an impact on their confidence in the topic. However, content understanding is a critical component of effective science teaching. To properly teach science education, teachers must have precise and extensive knowledge of the subject.

### 6.7. A Lack of Pedagogical Content Expertise

According to Buchmann (1982), teachers' pedagogical and subject matter knowledge are critical to effective science teaching and student comprehension. Furthermore, Shulman (1986) defines pedagogical content knowledge as a type of knowledge that produces scientific teachers rather than scientists. As a result, pedagogical content knowledge is a sort of knowledge that is unique to teachers and is based on how teachers relate their pedagogical knowledge (what they know, subject matter knowledge, and how to teach). Importantly, pedagogical content knowledge is viewed as a combination of teachers' pedagogical expertise and subject matter (Shulman, 1986).

## 7. Research Methodology and Design

This study included a qualitative research technique and purposive sampling. A qualitative methodology was utilized to conduct an in-depth analysis of the phenomenon under investigation (Neuman, 2014). This allowed researchers to engage directly with individuals and formulate notions derived from their experiences (Neuman, 2014). In accordance with qualitative research methodology, we meticulously selected a setting or a sufficiently sized group to prevent being inundated by the work (Bogdan & Biklen, 2003).

### 7.1. Research Design

Welman, Kruger, and Mitchell (2011) define research design primarily as the comprehensive plan for selecting respondents and the methods of data collection or generation. Conversely, Zikmund et al. (2003) argue that research design should be perceived as a composite approach, involving the selection of various alternatives and options to ensure the clarification and achievement of the research objectives and perspectives. A case study was selected as the preferred method for this research.

### 7.2. Clarification of Sampling and Justification of Sample Size

The sample used in this study was purposeful, with an emphasis on participants (Teachers) who might provide rich and relevant insights regarding the quality of science teaching and learning in the chosen context. Participants had to be qualified teachers who were currently teaching science in one of the selected rural schools. Only teachers with at least three years of teaching experience were invited to guarantee that they (as participants) received have adequate exposure to classroom techniques and how to implement the curriculum.

The study was carried out in an impoverished community schools, which have limited resources, large class numbers, and infrastructural challenges, all of which have a negative impact on scientific teaching and learning. These contextual aspects had a substantial impact on the teachers' experiences and perspectives throughout the study. The study comprised of teachers teaching science in the intermediate phase, specifically grade(s) 4 from the Dr. Kenneth Kaunda District in the Northwest Province. This range was chosen to give a more complete picture

of how science is taught at various developmental levels. The teachers' experience ranges from 3 to more than 15 years, guaranteeing a mix of relatively new and highly experienced teachers. In terms of qualifications, 5 of the participants earned a teaching diploma without specialising in science education, and 3 bachelor's degrees with a focus on scientific education.

Eight teachers were chosen for in-depth, semi-structured interviews. This sample size was deemed enough for a case study because the researcher's aim was not to generalise findings, but rather to obtain a full, contextualised understanding of the phenomenon. Data saturation was achieved during these eight interviews, as repeated themes and patterns developed, and additional interviews produced no important new information. As a result, the sample size was large enough to ensure the depth, credibility, and richness of the data collected.

### 7.3. Limitations of the Study

As with much qualitative research, this study had its own limits. It was undertaken in the Dr. Kenneth Kaunda District of South Africa's Northwest Province, with an emphasis on a small number of primary school science education teachers. However, the study's findings cannot be generalised to all teachers in other provinces of South Africa. As a result, a similar study should be conducted in other provinces to aid in the development of additional recommendations that can improve teachers' perceptions of the quality of scientific education teaching and learning in South African primary schools.

## 8. Results

The present study is aimed at investigating teachers' perceptions on quality teaching and learning of science education in primary schools. The key findings originating from this study were identified and grouped according to the themes that emerged during the data analysis as follows.

### 8.1. Poor Teaching Strategies Used for Teaching the Subject

T (4): As teachers, we do not use enough or various teaching approaches to teach science during classroom interactions. Some of us use inadequate methods to teach science subjects, particularly the textbook method. However, rather than simply conveying information and regulations, teachers must use active teaching approaches that promote self-motivation and independent learning. Umke and Nwafor (2014), on the other hand, argue that teaching approaches are an important component of science education. As a result, science education is viewed as an interdependent process that relies on the teacher's confidence in their knowledge of the scientific subject and conscious consideration of how their pupils learn science (Garraway-Lashley, 2019).

### 8.2. Poor Lesson Planning and Preparations

T (5): Teachers report that most science teachers at their school make no extra

effort to prepare lesson plans that increase student engagement. According to Shulman (1986), a lesson plan is defined as a document that outlines how the teacher will go about teaching a specific topic in a particular timeframe to meet objectives that are set out (Khozas, 2024). However, lesson planning is significant for quality teaching. Daily lesson planning is an important task for teachers since it immediately improves teaching quality and efficiency (Lepholletse, 2008). Effective lesson preparation increases the level of student involvement throughout the teaching process and provides recommendations to teachers. It is an essential component of the educational process (Vreken, 2001). In this case, interest is motivated by a combination of curiosity and arousal. A teacher has an important role to play in designing, planning, and implementing a lesson (Usak et al., 2022).

### 8.3. Inadequate Science Equipment or Laboratories

T (7): Teachers contend that the scarcity of scientific apparatus and the substandard state of the science laboratory render teachers susceptible while conducting experiments with students in the classroom. These teachers assert that most teachers are not properly qualified and lack the requisite teaching skills and comprehensive knowledge necessary for teaching primary school students in science education. The insufficiency of adequate scientific equipment or laboratories in educational institutions significantly hinders the quality of science teaching and comprehension, adversely affecting students' grasp of scientific concepts and their capacity to cultivate practical skills (Mangarin & Macayana, 2024; Kaunda, 1998). Mangarin and Macayana (2024) emphasised the crucial role of science laboratories in promoting scientific literacy and practical skills among students. They serve as a platform for experiential learning, enabling students to engage in hands-on activities that reinforce theoretical knowledge (Hudson, 1998).

### 8.4. Underqualified Science Teachers

T (6): At our school, we work with many teachers who are underqualified to teach science to students. We require additional training and workshops. We are unsure how to include technology in our teaching. Teachers face a complicated issue when it comes to teaching science. As a result, students in science education require teachers who are specialists in science disciplines and have qualifications and competency in science teaching (Botha, 2012; Kind, 2009).

The effectiveness of science teaching is significantly influenced by teachers' pedagogical knowledge and appropriate qualifications in the subject, which can greatly affect learners' learning outcomes Shulman (1986). Additionally, PCK is viewed as the knowledge that enables teachers to transform the subject matter knowledge in ways that make it understandable to learners (Usak et al., 2022). Botha (2012) and Tsal et al. (2006) assert that the quality of science education is connected to teachers' comprehension of the nature of science, their beliefs regarding teaching and learning in this field.

### 8.5. Lack of Content Knowledge and Pedagogical Knowledge

T (7): Teachers contend that most teachers do not have pedagogical and content knowledge of science. As such, this experience becomes a challenge and hinders their performance due to a misunderstanding of scientific concepts. According to Barnett and Hodson (2001), Botha (2012), teaching is a complicated undertaking that requires many forms of knowledge. In essence, the quality of teaching science requires teachers to acquire specific knowledge together with mastery of content knowledge (Hudson, 2004). Thus, for teachers to assist learners to learn science effectively, they need to have a strong knowledge of essential ideas of this discipline (Garraway-Lashley, 2019). However, the main criterion for successful teachers is to have a solid knowledge base that includes a mixture of content knowledge and pedagogical knowledge or knowledge of teaching (Usak et al., 2022).

### 8.6. Poor Infrastructure and Learning Environment

T (5): As you can see, our school's building is very ancient and dilapidated. We do not have sufficient restrooms for learners and teachers, no electricity, yet digital learning is mandatory, the classrooms are overcrowded, and others are teaching in multi-grade classes. We, as teachers, are concerned about the inadequate infrastructure in our schools. However, it is believed that a lack of suitable infrastructure has an impact on learners' academic progress around the world (Mokgwathi et al., 2025). Furthermore, Bhunia et al. (2012) claimed that the development of education depends on many factors, such as the infrastructure resources available to a school.

### 8.7. Curriculum Implementation Challenges

T (8): It is challenging for us as teachers to execute science curricula due to inexperienced teachers who are unable to teach and understand science terminology or concepts. They have no prior knowledge of the subject field and are just assigned to teach it. This brings chaos in school. According to Booi and Khuzwayo (2019), teachers who graduated from qualification programmes were mostly inept in all professional areas, namely academic subject content knowledge and pedagogy.

## 9. Analysis and Discussions: A Self-Efficacy Perspective

The outcomes of this study were interpreted through the lens of teacher self-efficacy, using Bandura's (1997) paradigm, which highlights three interconnected dimensions: teacher confidence (efficacy beliefs), outcome expectancy, and classroom practice. The investigation reveals how structural and pedagogical constraints impair teachers' views in their capacities, hence shaping the quality of teaching and learner outcomes in science classrooms.

### 9.1. Poor Teaching Strategies Used

This study found that teachers relied largely on rote learning, a teacher-oriented

approach, and limited learner interaction. However, from a self-efficacy standpoint, this implies low instructional confidence, since teachers question their capacity to promote active, inquiry-based learning. Teachers with low self-efficacy reject challenging or novel teaching tactics, preferring safer, more familiar alternatives. This is consistent with lower outcome expectations, as teachers are less likely to believe that alternative strategies will improve learner knowledge. As a result, classroom practice becomes rigid and unresponsive to learner requirements, perpetuating poor learning outcomes.

### 9.2. Poor Lesson Planning and Preparations

Inadequate lesson planning has emerged as a major barrier to successful teaching and learning. Teachers in this study noted inadequate preparation, ambiguous objectives, and poor alignment between material and evaluation. As a result, under the self-efficacy paradigm, poor planning implies low confidence in one's capacity to organise and perform educational duties. Teachers with low self-efficacy are less likely to invest time in thorough preparation since they expect limited success despite their efforts. This lack of anticipation leads to fragmented classroom practices in which classes lack structure, progression, and pedagogical direction.

### 9.3. Inadequate Science Equipment

The scarcity of laboratory resources and teaching materials hampered practical work and experimentation. Teachers in this study reported having trouble teaching scientific concepts effectively. This resource limitation has a detrimental impact on efficacy beliefs because teachers believe their teaching capacity is dependent on unavailable resources. Over time, this lowers outcome expectations because teachers may assume that significant science learning is impossible without equipment. As a result, classroom practice tends toward theoretical teaching, which limits experimental learning and reinforces learner disengagement.

### 9.4. Underqualified Science Teachers

The presence of teachers without specialised science training significantly influenced the quality of teaching. Teachers expressed uncertainty in content delivery. From a self-efficacy standpoint, limited qualifications undermine content-specific teaching confidence.

## 10. Discussion and Findings

Quality education is acknowledged as a fundamental pillar for developmental progress in society and plays a significant part in shaping and empowering the future of individuals and the communities (Lombo & Subbon, 2024). However, the alarming decline of the quality of education, particularly science education in South African elementary schools is significant (Botha, 2012; Bantwini, 2017). This encompasses multiple research projects that pertain to the statement. This study found numerous elements that affect the quality of scientific education teaching

in elementary schools within the South African context. The problems identified include inadequate teaching methodologies employed by science teachers, insufficient comprehension of scientific concepts, the absence of appropriate qualifications for teaching science, limited topic knowledge, curriculum implementation challenges, lack of infrastructure, and apparatus.

However, teachers consistently reported that the quality of science teaching and learning in elementary school is negatively influenced by lack of resources. However, many primary schools especially in the disadvantaged communities lack laboratories which are full equipped and scientific tools. Therefore, most teachers are dependent heavily on theoretical teaching than practical experiment, which reduces learners' understanding of scientific concepts. This limitation of resources leads to poor learner engagement and poor performance in science subjects.

Findings also reveal that some teachers in schools are underqualified and have no professional qualifications or teaching subjects outside their areas of specialisation. They also express a need for more training workshops, particularly in modern teaching strategies and the implementation of technology in science education. However, this gap affects their confidence and ability to deliver high-quality lessons. High-quality teaching is essential for the overall standard of primary and secondary education. Therefore, for teachers to deliver high-quality teaching in science education, they must necessitate opportunities for ongoing professional development and acquire knowledge about contemporary advancements in their subjects, alongside the implementation of innovative pedagogical methods during teaching and learning practices (OECD, 2009).

Teachers noted that many elementary school students have low enthusiasm and attitudes toward science subjects. On the other hand, Menjo and Chepkorir (2013) maintain that attitudes toward science appear to influence learners' participation in science subjects and their outcomes in science. This is sometimes ascribed to a lack of exposure to science-related career fairs and a scarcity of science role models in their neighbourhood. Language becomes another factor impediment when learners are taught in a second language, making it difficult for them to grasp complicated scientific concepts and contributing to low academic achievement.

The study also discovered that scientific education teachers lacked material and pedagogical knowledge of the subject. Paucities in scientific teachers' content knowledge (CK) and pedagogical knowledge (PCK) typically lead to inefficient teaching and learning. However, to ensure great teaching and learning in science education, topic content must be blended with effective teaching approaches. The survey also found that curriculum implementation is an issue.

According to Obianuju & Stella (2022), the goal of curricular innovation and change is to attain the intended outcome at the end of implementation. Furthermore, as the nation's scientific advancements continue, the content of science education is being revised to reflect the changing world and new dimensions (Obianuju & Stella, 2022). They went on to suggest that such new dimensions include self-reliant education, population and family life education, global warming and

the greenhouse effect, bioethics, and environmental degradation, all of which are major issues if not implemented.

## 11. Trustworthiness of the Study

This study established trustworthiness and credibility by building strong relationships with participants and ensuring that their exact words were transmitted in the current study. To accomplish conformity, the researcher kept a neutral attitude and ensured that her opinion did not influence the study's findings. To ensure trustworthiness, the researcher employed separate codes. Two colleagues assessed the coding procedure and emergent themes to ensure consistency and reduce researcher bias, thereby validating the accuracy of the coding and interpretation.

## 12. Ethical Consideration

This investigation included ethical considerations. All participants were informed about the study's goal and made aware that their participation was entirely voluntary. The researcher guaranteed the participants that their identities would be protected and that no names of participants would be revealed to the public.

## 13. Conclusion

Science education is a foundational component in the development of scientific literacy, critical thinking and innovation among learners (Escuzar, 2025). It empowers individuals with problem-solving skills and creativity, which drive sustainable development and give explicit consideration to improving the learners' interest in and attitudes as early in their primary school phase. However, efforts should be made to improve science education in primary schools in South Africa because of the continued failure of teachers to perform well in their teaching process. Advanced teaching strategies for science education can be developed by subject specialists who have a significant impact on learners' scholastic achievement. The professional development in a climate of educational reform must address the total challenge of implementing educational standards, working with a diverse population, and changing forms of learner assessment (Oyelekan et al., 2017). However, it plays an important part in the successful educational reforms, and it cannot be overemphasised. Further research should be conducted in teacher education training programmes to address and improve the level of science education teachers in South Africa. This situation, however, appeals to the South African Government to outline its policies by imitating the education system of the best achievers and by using international comparison strategies.

## 14. Recommendations

- I recommend that the Department of Basic Education (DBE) include science education programmes in primary schools.
- I recommend that teachers be professionally developed to teach. Progressive

professional development programmes and workshops should be put in place by DBE.

- I recommend that the DBE hires specialised qualified teachers and place them in their field of specialisation.

## Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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