e-ISSN: 2710-2122, p-ISSN: 2710-2114
2024: Vol 6, pp 1-16. https://doi.org/10.38140/ijer-2024.vol6.29
Interdisciplinary Journal of Education Research

# Navigating Challenges and Crafting Solutions: Implementing CAPS for Grade 7 Natural Sciences in Rural South African Schools

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**EDITORIAL DATES**
Received: 24 May 2024
Revised: 24 July 2024
Accepted: 14 August 2024
Published: 23 August 2024



**DOI: 10.38140/ijer-2024.vol6.29**

**Abstract:** This qualitative study explores the implementation of the Curriculum and Assessment Policy Statement (CAPS) for Grade 7 Natural Sciences in two rural schools in the Eastern Cape, South Africa. The researcher uses semi-structured interviews and classroom observations with six teachers to investigate the challenges and adaptations in CAPS implementation within resource-constrained environments. The study reveals significant hurdles, including severe resource limitations, language barriers, and assessment difficulties. The findings highlight teachers' remarkable creativity in adapting CAPS to rural contexts by using locally available materials and innovative teaching strategies. However, these adaptations often fall short of fully meeting curriculum requirements, which could potentially widen the educational gap between rural and urban learners. The study emphasises the need for context-specific professional development, flexible assessment guidelines, and tailored resources to support effective CAPS implementation in rural settings. It argues for a more nuanced approach to curriculum design and implementation that takes into consideration the unique socio-cultural and resource contexts of rural schools. This research contributes to our understanding of curriculum implementation in challenging contexts and provides insights for improving science education in rural South Africa.

***Keywords:*** CAPS implementation, rural education, Natural Sciences, teacher adaptations, resource constraints.

## 1. Introduction

The implementation of the Curriculum and Assessment Policy Statement (CAPS) in South African schools is a significant challenge, especially in resource-constrained rural areas. The introduction of CAPS in 2012 aimed to address the shortcomings of previous curriculum reforms and provide a more structured approach to teaching and learning across all subjects and grades (Department of Basic Education, 2011). However, for Grade 7 Natural Sciences teachers, this change has presented both opportunities and challenges, particularly in rural contexts where resources are often limited and support systems may be inadequate. The Eastern Cape province, with its predominantly rural landscape and historical educational disparities, offers a unique context for studying the implementation of CAPS. Rural schools in this region face numerous challenges, including inadequate infrastructure, limited access to resources, and a shortage of qualified teachers (Mafora & Phorabatho, 2013). These factors can significantly impact the effective implementation of new curriculum policies, particularly in subjects like Natural Sciences that require practical experiments and up-to-date scientific knowledge.

Grade 7 Natural Sciences is a critical subject in the senior phase of the General Education and Training band, as it plays a vital role in developing learners' scientific literacy and preparing them for further studies in science-related fields. The CAPS for Natural Sciences emphasises the integration of science, technology, society, and the environment, which requires teachers to adopt

**How to cite this article:**
Pillay, P. (2024). Navigating challenges and crafting solutions: Implementing CAPS for grade 7 natural sciences in rural South African schools. *Interdisciplinary Journal of Education Research, 6*, 1–16. https://doi.org/10.38140/ijer-2024.vol6.29

new teaching approaches and assessment methods (Department of Basic Education, 2011). However, this shift demands not only content knowledge but also pedagogical skills that may be challenging for teachers in rural settings to acquire and implement effectively.

While understanding teachers' experiences in implementing new curricula is important, there is limited research specifically focusing on Grade 7 Natural Sciences teachers in rural Eastern Cape schools. Previous studies have highlighted general challenges in CAPS implementation across various subjects and provinces. For example, Maharajh et al. (2016) identified issues such as inadequate teacher training and resource shortages in KwaZulu Natal primary schools. Moodley (2013) pointed out difficulties in assessment practices and time management across various subjects. More recently, Mafugu and Mafora (2020) highlighted significant hurdles in implementing CAPS in multi-grade classrooms, including resource shortages and inadequate teacher preparation. In the context of science education, Ramnarain and Hlatshwayo (2018) noted tensions between the inquiry-based approach advocated by CAPS and teachers' traditional pedagogical orientations, especially in rural and township schools.

However, the unique experiences of Natural Sciences teachers in rural contexts remain underexplored. This study aims to address this gap by exploring the experiences of Grade 7 Natural Sciences teachers in implementing CAPS at two rural schools in the Eastern Cape. By examining their perceptions, challenges, and adaptations, insights into the realities of curriculum implementation in resource-constrained environments can be provided. Understanding these experiences is crucial for informing policy decisions, improving teacher support systems, and ultimately enhancing the quality of science education in rural South African schools.

The central questions guiding this research are:

- How do Grade 7 Natural Sciences teachers in rural Eastern Cape schools implement the CAPS curriculum in their resource-constrained environments?
- What challenges do these teachers face in implementing CAPS for Natural Sciences, and what adaptive strategies do they employ to overcome these challenges?
- How does the rural context influence the effectiveness of CAPS implementation in Grade 7 Natural Sciences classrooms, and what implications does this have for curriculum design and teacher support?

By addressing these questions, this study aims to contribute to the broader understanding of curriculum implementation in challenging contexts. It also provides valuable insights for policymakers, educational leaders, and teacher educators who are working to improve science education in rural South Africa.

## 2. Literature Review

Scholars Mukeredzi and Mandrona (2013) assert that the implementation of the Curriculum and Assessment Policy Statement (CAPS) in rural South African schools aims to standardise and enhance the quality of education nationwide. In line with this, Msimanga (2019) defines CAPS as a comprehensive curriculum reform aimed at addressing the educational disparities within the system, emphasising the importance of its effective implementation in bridging the educational divide between urban and rural areas. Building on an earlier study by Ramnarain and Hlatshwayo (2018), Masinire et al. (2021) describe the implementation of CAPS in rural schools as a challenging yet potentially transformative process, highlighting the need for significant adaptation to local contexts and resource limitations.

Multiple research studies have systematically investigated the implementation of CAPS in rural science classrooms (Ngema et al., 2020; Mudau & Nkopodi, 2021). Mavhunga and Rollnick (2017) identify three distinct aspects of CAPS implementation in rural schools: curriculum interpretation, resource adaptation, and assessment practices. It is noteworthy that although the teaching and

learning of Natural Sciences have shifted towards a learner-centred approach in CAPS, Mbatha (2016) indicates that the practical implementation in rural schools has remained challenging due to resource constraints and inadequate teacher preparation. Despite the initial assertions about the significance and value of CAPS in enhancing learners' scientific literacy and skills (Department of Basic Education, 2011) within the rural education context, minimal progress has been made in addressing the unique challenges faced by rural schools in implementing the curriculum. Nkambule and Mukeredzi (2017) emphasise the vital role of integrating CAPS into teaching and learning for national development. Regrettably, the quality of CAPS implementation in teaching and learning Natural Sciences in rural schools remains a major concern (Mafugu & Mafora, 2020).

## 2.1 Challenges Natural Sciences teachers face in implementing CAPS in rural schools

Despite the extensively documented advantages of the CAPS in pedagogy, teachers in rural schools encounter numerous obstacles when integrating it into their Natural Sciences classrooms. These challenges encompass overcrowded classrooms, inadequate physical and material resources, the suitability of support materials for learners and teachers, and the language employed for learning and teaching (Msimanga & Lelliot, 2021). Maebuta and Mlambo (2019) contend that when teachers plan to implement practical activities as stipulated by CAPS in large classes, they tend to reduce the number of experiments or resort to demonstrations, compromising the hands-on learning experience emphasised in the curriculum. Maebuta and Mlambo (2019) further explain that even if teachers intend to conduct group work in large classes, limited space hampers their ability to manoeuvre and facilitate effective collaborative learning, which could enhance their understanding of scientific concepts.

Adopting a pragmatic standpoint, Maddock and Maroun (2018) recommend that rural schools receive adequate resources to ensure the implementation of CAPS without compromising the quality of science education, thereby enabling learners to develop essential scientific skills and knowledge. Furthermore, the lack of resources affects the equity of CAPS implementation, as learners from rural schools may receive a less comprehensive science education compared to their urban peers due to resource disparities, potentially exacerbating achievement gaps in science subjects. Another challenge in implementing CAPS is the language employed for learning and teaching (LoLT). For instance, Ferreira and Schulze (2018) identified three language-related challenges in rural science classrooms: home language, instructional language, and scientific language. Learners bring their home languages into science classes, and Natural Sciences teachers are expected to assist learners in transitioning from their home language to the instructional language and scientific language. This poses a significant challenge for Natural Sciences teachers in implementing CAPS within the context of rural science teaching and learning.

Gudyanga and Jita (2018) underscore the issue of teacher preparedness in rural schools, noting that many teachers feel inadequately trained to implement the inquiry-based learning approaches emphasised in CAPS for Natural Sciences. This is compounded by limited opportunities for professional development in rural areas, as observed by Bantwini and Msongelwa-Nkosi (2015) in their study of teacher professional development needs in the Eastern Cape. The disconnect between the curriculum's expectations and the realities of rural classrooms often leads to what Chisholm and Wildeman (2013) term as "curriculum adaptation," where teachers modify CAPS to fit their context, sometimes at the expense of core learning objectives.

Moreover, Moletsane (2012) points out that the cultural relevance of the CAPS curriculum in rural contexts is often overlooked. The curriculum's content and examples may not always resonate with the lived experiences of rural learners, making it challenging for teachers to establish meaningful connections between scientific concepts and learners' daily lives. This cultural disconnect can impact learner engagement and understanding, as noted by Nhalevilo (2021) in her study of indigenous knowledge integration in science education.

In conclusion, while CAPS aims to standardise and enhance science education across South Africa, its implementation in rural schools for grade 7 Natural Sciences encounters significant challenges. These challenges encompass resource constraints, language barriers, issues of teacher preparedness, and cultural relevance. Addressing these challenges necessitates a comprehensive approach that takes into account the unique context of rural education and provides targeted support to both teachers and learners.

## 3. Theoretical Framework

This study is informed by two complementary theoretical perspectives: Bronfenbrenner's Ecological Systems Theory and the Technological Pedagogical Content Knowledge (TPACK) framework. These theories provide a comprehensive lens through which to examine the experiences of Grade 7 Natural Sciences teachers implementing CAPS in rural Eastern Cape schools.

### 3.1 Bronfenbrenner's Ecological Systems theory

Bronfenbrenner's Ecological Systems Theory (Bronfenbrenner, 1979) suggests that human development is influenced by various environmental systems. This theory is particularly relevant to understanding the complex interplay of factors that affect teachers' experiences in implementing CAPS in rural contexts. The theory identifies five environmental systems: the microsystem, mesosystem, exosystem, macrosystem, and chronosystem. Recent applications of this theory in educational research have demonstrated its value in understanding teacher development and curriculum implementation. For example, Geldenhuys and Wevers (2013) used this framework to explore inclusive education implementation in South Africa, highlighting how various systemic levels influence teachers' practices. Their study showed that factors at multiple ecological levels, from immediate classroom environments to broader educational policies, significantly impact teachers' ability to implement new educational approaches. This finding is relevant to our study on CAPS implementation in rural Natural Sciences classrooms. Just as inclusive education requires teachers to navigate complex systemic influences, CAPS implementation in rural settings involves similar multi-level challenges. By applying Bronfenbrenner's framework, we can examine how factors such as resource constraints (microsystem), school leadership (mesosystem), district support (exosystem), and national curriculum policies (macrosystem) interact to shape teachers' experiences and practices in implementing CAPS. This approach allows us to move beyond individual teacher competencies to understand the broader ecological context influencing curriculum implementation in rural schools. It potentially reveals intervention points at various systemic levels to support more effective CAPS implementation in these challenging environments.

Bronfenbrenner's Ecological Systems Theory is relevant to this study as it provides a holistic examination of the various factors influencing teachers' experiences with CAPS implementation. It acknowledges that teachers' abilities to implement the curriculum are not solely determined by their individual skills or the immediate school environment but are also shaped by broader systemic factors. Mukeredzi (2013) applied this theory to rural teacher professional development in South Africa, demonstrating how contextual factors at different ecological levels impact teachers' growth and practice. Similarly, Onwu and Mogari (2004) used an ecological perspective to examine science education in South African townships, emphasising the importance of considering multiple environmental influences on teaching and learning. While Bronfenbrenner's Ecological Systems Theory provides a comprehensive framework for understanding the various contextual factors influencing CAPS implementation, it does not specifically address the knowledge and skills required for effective science teaching. This limitation necessitates the incorporation of a complementary framework that focuses on teacher competencies in science education.

To address this gap, the researcher introduces the Technological Pedagogical Content Knowledge (TPACK) framework alongside the Ecological Systems Theory. TPACK offers a model for

understanding the types of knowledge required for effective teaching, particularly in science education where technological integration is increasingly important. By combining these two theories, both the broader systemic influences on CAPS implementation and the specific knowledge domains that teachers need to navigate in their science classrooms can be examined. This dual theoretical approach allows for a more comprehensive analysis of the challenges and opportunities in implementing CAPS for Grade 7 Natural Sciences in rural Eastern Cape schools, addressing both the contextual factors and the specific teacher competencies required for successful curriculum implementation.

### 3.2 Technological Pedagogical Content Knowledge (TPACK) framework

The TPACK framework, developed by Mishra and Koehler (2006), offers a model for comprehending the types of knowledge necessary for proficient teaching with technology. This framework holds particular relevance to the implementation of CAPS in Natural Sciences, where the integration of technology is increasingly crucial. TPACK comprises three primary forms of knowledge: Content Knowledge (CK), Pedagogical Knowledge (PK), and Technological Knowledge (TK). The intersections of these knowledge domains give rise to four additional types of knowledge: Pedagogical Content Knowledge (PCK), Technological Content Knowledge (TCK), Technological Pedagogical Knowledge (TPK), and Technological Pedagogical Content Knowledge (TPACK).

In the South African context, several studies have applied the TPACK framework to explore teachers' competencies and challenges. Leendertz et al. (2013) employed TPACK to investigate the integration of technology by mathematics teachers in South African schools, revealing significant deficiencies in teachers' technological knowledge and its integration with content and pedagogy. Jita (2018) used TPACK to examine the readiness of science teachers for technology integration in rural South African schools, emphasising the need for targeted professional development that addresses all aspects of the TPACK framework.

This framework informs the present study by providing a structure to analyse teachers' knowledge and skills in implementing CAPS for Natural Sciences. It enables an examination of how teachers integrate their understanding of science content, pedagogical strategies, and available technologies within their rural school contexts. The TPACK framework is particularly pertinent considering the emphasis in CAPS on integrating technology into science education and the potential challenges this poses in resource-limited rural environments. Mestry and Ndhlovu (2014) underscored the significance of considering technological knowledge alongside content and pedagogy in implementing curriculum changes in South African schools, particularly in disadvantaged areas.

By employing both Bronfenbrenner's Ecological Systems Theory and the TPACK framework, this study seeks to provide a comprehensive understanding of the multi-faceted challenges and opportunities encountered by Grade 7 Natural Sciences teachers in implementing CAPS in rural Eastern Cape schools. This theoretical approach allows for an analysis that takes into account both the broader contextual factors influencing curriculum implementation and the specific knowledge and skills necessary for effective science teaching in these settings. The combination of these frameworks aligns with recent calls for more integrated approaches to comprehending curriculum implementation in diverse contexts (Chisholm & Wildeman, 2013; Ramnarain & Hlatshwayo, 2018).

## 4. Research Methodology

This study utilised a phenomenological research design grounded in the interpretive qualitative paradigm as the chosen mode of inquiry. The phenomenological approach was selected due to its focus on the lived experiences of grade 7 Natural Sciences teachers in rural settings. Two rural schools in the Eastern Cape were designated as research sites. Qualitative data were collected through semi-structured individual interviews and non-participant classroom observations. A few closed questions were included to gather background and demographic information, such as participants'

highest qualifications and teaching experience. However, the interview questions primarily consisted of open-ended prompts to allow participants to freely share their experiences.

Upon obtaining permission from the Eastern Cape Department of Education and school principals to serve as gatekeepers and explain the research procedure, the researcher recruited six grade 7 Natural Sciences teachers from the two selected rural schools in the Amathole District, Eastern Cape, South Africa. Purposive sampling was employed to select the teachers as participants, and they provided consent by signing forms ensuring privacy and confidentiality. The Natural Sciences teachers were chosen as relevant and information-rich participants capable of addressing the research question. Each individual interview lasted approximately 45 minutes to one hour. Additionally, the researcher conducted non-participant classroom observations as an additional data collection method in the two schools serving as research sites. In each school, three grade 7 Natural Sciences lessons were observed to examine how each teacher incorporates CAPS guidelines into their classroom practices, with a particular focus on adapting to the rural context and resource constraints. The researcher employed non-participant classroom observation as a means to supplement the data collected during the semi-structured interviews with evidence of the actual teaching practices implemented by the teachers.

Thematic analysis, following the guidelines outlined by Braun and Clarke (2006), was employed to analyse the data. Thematic analysis was deemed appropriate for this study as it helps to reinforce the study's focus and prevents analysis from deviating, thus strengthening the investigation into CAPS implementation in rural settings, as suggested by Nhlumayo (2016). To generate themes, the researcher coded the data by identifying common findings from participants' responses during the semi-structured interviews, and subsequently cross-referenced those findings with the data collected from classroom observations.

To ensure trustworthiness, member checking was utilised, wherein participants were given the opportunity to review the transcripts of their interviews and offer feedback or clarifications. Additionally, triangulation was achieved by employing multiple data collection methods (interviews and observations) and having multiple external researchers independently code the data before refining the themes. Ethical considerations were prioritised throughout the research process. In addition to obtaining formal permissions, the researcher ensured that participants were fully informed about the nature of the study and their rights to withdraw at any time. Given the limited number of schools involved, special care was taken to maintain anonymity when reporting the findings.

## 5. Presentation of Data

The study sampled six (6) Grade 7 Natural Sciences teachers from 2 purposively selected rural schools in the Amathole District of the Eastern Cape. It is important to mention that pseudonyms were used to identify the participants in this study. T1 to T6 refers to Natural Sciences teachers 1 to 6. The demographic profile of the participants is provided in Table 1 below.

***Table 1:*** *Demographic profile of participants*

| Participant | Qualifications | Gender | School | Teaching Experience |
|---|---|---|---|---|
| T1 | B.Ed. | Female | A | 5 Years |
| T2 | B.Ed. | Male | A | 3 Years |
| T3 | B.Ed. Honours | Female | A | 11 Years |
| T4 | BSc & PGCE | Male | B | 6 Years |
| T5 | B.Ed. | Female | B | 4 Years |
| T6 | B.Ed. Honours | Male | B | 9 Years |

Keys: B.Ed. = Bachelor of Education Degree, PGCE = Post Graduate Certificate in Education

After collecting the data, researcher organised it to facilitate analysis. This included transcribing interviews, categorising observations, and coding textual data. By constantly comparing and iteratively analysing, researchers identified similarities and differences in the coded data, checking for recurring ideas, concepts, and experiences across the collected data. Throughout this process, researchers maintained reflexivity, acknowledging their biases and assumptions, and remaining open to unexpected findings.

Key findings from the study were clustered according to themes that emerged during data analysis. These themes include: Adaptation of CAPS for rural contexts in Natural Sciences classrooms, Resource challenges in implementing CAPS for Grade 7 Natural Sciences, Language and cultural considerations in CAPS implementation, and Assessment practices and challenges in rural Natural Sciences classrooms.

Verbatim quotes from participants represent the individual voices of the teachers, and the findings from the classroom observations enhance the data. For example, on adapting CAPS for rural contexts, **T3** stated: "*We often have to modify the prescribed experiments to use locally available materials. For instance, when teaching about plant biology, we use plants from our school garden instead of the specific examples in the textbook*." Regarding resource challenges, **T4** noted: "*Lack of laboratory equipment is our biggest hurdle. We've learned to be creative, but it's challenging to meet all CAPS requirements without proper resources.*"

**T2** highlighted language considerations: "*Many of our learners struggle with English as the medium of instruction. We often have to explain scientific concepts in isiXhosa first, then bridge to English terminology.*" On assessment practices, **T6** shared: "*Continuous assessment as required by CAPS is difficult with large classes. We've started using peer assessment strategies to manage the workload.*"

Classroom observations corroborated these statements, revealing innovative adaptations of CAPS guidelines to suit rural contexts, such as using outdoor spaces for science lessons and integrating local knowledge into the curriculum. For instance, in **T1**'s class, learners were observed conducting a soil erosion experiment using the school's sloped grounds, demonstrating how teachers adapt to their environment to meet CAPS requirements.

The subsequent sections delves deeper into each theme, providing a comprehensive analysis of the data collected and its implications for CAPS implementation in rural Eastern Cape schools. This analysis will draw on both the interview data and classroom observations to present a holistic picture of the challenges and strategies employed by Grade 7 Natural Sciences teachers in these rural settings.

## 5.1 Adapting CAPS for rural grade 7 natural sciences classrooms

This theme primarily addresses the first research question: How do Grade 7 Natural Sciences teachers in rural Eastern Cape schools implement the CAPS curriculum in their resource-constrained environments?" The investigation into CAPS implementation revealed diverse strategies employed by educators to tailor the curriculum to their rural setting. Teachers demonstrated remarkable ingenuity in overcoming resource limitations to foster scientific understanding among learners. Their approaches were varied and context-specific. Here is how they responded:

> "*Our school yard becomes our laboratory,*" explained **T3**. "*When discussing biodiversity, we conduct field studies right outside the classroom, identifying local flora and fauna.*"
>
> **T1** *shared an innovative approach: "For astronomy lessons, we craft models using everyday items. Once, we represented the solar system using fruits of varying sizes – it was both educational and entertaining for the learners.*"
>
> "*Collaborative learning is key in our resource-scarce environment,*" **T5** noted. "*Group discussions help compensate for the shortage of textbooks and allow peers to support each other's learning.*"

> **T4** described adapting to equipment shortages*: "We often resort to whole-class demonstrations. I encourage learner participation by asking for predictions and explanations of observed phenomena."*

These accounts demonstrate the teachers' adaptability in implementing CAPS despite challenging circumstances. Their methods align with recent educational research that suggests contextualising science education enhances learner engagement and comprehension, particularly in rural settings (Ramnarain & Hlatshwayo, 2018; Masinire et al., 2021).

Classroom observations support these reports. For example, T2 was seen conducting a botany lesson using a small garden plot adjacent to the classroom, demonstrating how educators creatively meet curriculum requirements within environmental constraints. This aligns with Ngema et al.'s (2020) findings on innovative practices in resource-constrained science classrooms. In T3's class, learners were observed collecting and categorising local plant specimens, creating a makeshift herbarium using recycled materials. T1's astronomy lesson involved learners creating scale models of the solar system using various fruits, showcasing both creativity and effective use of available resources. T5's classroom was arranged in small groups, with learners actively engaged in peer discussions about energy conservation, demonstrating the implementation of collaborative learning strategies.

### 5.2 Hurdles in CAPS Implementation for Rural Grade 7 Natural Sciences

This theme addresses the second research question: What challenges do these teachers face in implementing CAPS for Natural Sciences, and what adaptive strategies do they employ to overcome these challenges? Participants identified several obstacles in their efforts to fully implement CAPS. Primary among these were the scarcity of teaching resources and linguistic challenges. Here, we present educators' perspectives on these issues:

> *"Full CAPS implementation is hindered by our lack of resources,"* **T6** admitted. *"We often resort to theoretical teaching of practical concepts due to insufficient laboratory equipment."*
>
> **T2** described their resourcefulness*: "We've learned to improvise with locally available materials. Plastic bottles, for instance, become tools for demonstrating air pressure principles."*
>
> *"A proper science laboratory is at the top of our wishlist,"* **T4** emphasised. *"Its absence makes meeting CAPS practical requirements a constant struggle."*

These responses highlight the significant challenges teachers face when implementing CAPS in resource-constrained environments. The lack of proper laboratory facilities and the need for linguistic adaptations are particularly prominent issues, which align with the findings from Mafugu and Mafora (2020) on resource disparities in rural education.

Observations in the classrooms confirmed these challenges. During T6's lesson on chemical reactions, the teacher was limited to using drawings and verbal descriptions instead of conducting actual experiments. In another instance, T2 used plastic bottles and balloons to demonstrate air pressure principles, showcasing creativity but also emphasising the lack of standard laboratory equipment.

While teachers demonstrated remarkable ingenuity in overcoming these limitations, the lack of proper equipment and materials remained a persistent hurdle in implementing CAPS. Their experiences shed light on the gap between CAPS requirements and the realities of rural schools.:

> *"Full CAPS implementation is hindered by our lack of resources,"* **T6** admitted. *"We often resort to theoretical teaching of practical concepts due to insufficient laboratory equipment. For instance, when the curriculum requires learners to observe cell structures, we end up drawing diagrams on the board instead of using microscopes."*
>
> **T2** described *their resourcefulness: "We've learned to improvise with locally available materials. Plastic bottles, for instance, become tools for demonstrating air pressure principles.*

> *Once, we created a model of the lungs using balloons and plastic bags to show breathing mechanics."*
>
> *"A proper science laboratory is at the top of our wishlist,"* **T4** emphasised. *"Its absence makes meeting CAPS practical requirements a constant struggle. We can't conduct many of the prescribed experiments, which impacts our learners' understanding of scientific processes."*
>
> **T1** highlighted the impact on learner engagement*: "The lack of hands-on materials makes it challenging to keep learners interested. Science should be interactive, but we're often limited to textbook descriptions and simple demonstrations."*
>
> **T5** noted the financial strain*: "Sometimes, we buy basic materials out of our own pockets. Things like vinegar for chemical reaction demonstrations or seeds for plant growth experiments – small items, but they add up, and it's not sustainable."*

The lack of proper laboratory facilities and basic scientific equipment is a prominent issue, aligning with Mafugu and Mafora's (2020) findings on resource disparities in rural education.

Classroom observations support these reports, revealing innovative yet limited adaptations to resource scarcity. For example, in T6's lesson on chemical reactions, the teacher used a mixture of vinegar and baking soda to demonstrate acid-base reactions. While creative, this simple demonstration fell short of the more complex experiments outlined in CAPS, limiting learners' exposure to varied chemical processes. In T2's physics lesson on forces, learners used rubber bands and small objects found in the classroom to create makeshift force meters. Although this approach allowed for some hands-on learning, the lack of precision in these improvised tools potentially impacted the accuracy of learners' observations. During T4's lesson on the solar system, learners created scale models using various sized fruits and vegetables. While engaging, this method couldn't capture the dynamic nature of planetary motion as effectively as a proper planetarium model or educational software might have. In T1's biology practical, learners examined plant structures using a magnifying glass passed around the class. However, the single magnifying glass for a large group meant limited individual observation time, contrasting sharply with CAPS' emphasis on developing individual scientific inquiry skills. In T5's classroom, a wall was dedicated to displaying hand-drawn scientific diagrams and charts, substituting for the lack of professionally produced educational posters or interactive displays. While commendable, this approach limited the variety and depth of visual aids available to support learning.

These observations highlight the creative efforts of teachers to meet CAPS requirements within severe resource constraints. However, they also underscore the significant gap between the curriculum's expectations and the realities of rural school settings. This disparity poses a substantial challenge to providing equitable, high-quality science education as envisioned by CAPS, echoing concerns raised by Ramnarain and Hlatshwayo (2018) about the implementation of inquiry-based science education in under-resourced schools.

On assessment practices and challenges, teachers provided detailed insights:

> **T6** shared*: "Continuous assessment as required by CAPS is difficult with large classes. We've started using peer assessment strategies to manage the workload, but ensuring consistency and fairness remains a challenge."*
>
> **T1** elaborated on practical assessment difficulties*: "CAPS requires us to assess practical skills, but without a lab, it's nearly impossible. We try to improvise with household items, but it's not the same as having proper equipment. For instance, when assessing learners' ability to use a microscope, we had to create a mock-up using cardboard boxes."*
>
> **T5** highlighted the challenge of language in assessments*: "Even when learners understand the concepts in isiXhosa, they struggle to express their knowledge in English*

> *during written assessments. This affects their performance and doesn't accurately reflect their understanding.*"
>
> **T3** pointed out time constraints*: "The CAPS assessment requirements are extensive, but we have limited time. Balancing thorough assessment with covering the curriculum content is a constant struggle. Sometimes, we have to rush through topics to make time for assessments.*"

Classroom observations confirmed these statements. In T6's class, learners were seen engaging in peer assessments of group projects on ecosystem models, which demonstrated the teacher's ability to adapt to large class sizes. During T1's lesson, an improvised 'lab practical' assessment was conducted using everyday items to represent scientific equipment. This showcased the creative approaches teachers employ to meet CAPS requirements, even when resources are limited.

In T5's assessment session, learners were observed first discussing answers in isiXhosa before writing them in English. This illustrated the language barrier that exists in assessments. In T3's lesson, there was a fast-paced review of multiple topics followed by a quick assessment. This highlighted the time pressure that teachers face when balancing content coverage with assessment requirements.

### 5.3 Professional growth needs of rural grade 7 natural sciences teachers

This theme provides insights into the third research question: How does the rural context influence the effectiveness of CAPS implementation in Grade 7 Natural Sciences classrooms, and what implications does this have for curriculum design and teacher support? The data underscored a pressing need for tailored professional development to enhance CAPS implementation in rural contexts. Participants expressed their experiences and aspirations for professional growth:

> "*Current workshops often overlook the unique challenges of rural CAPS implementation,*" **T2** observed. "*We need training that addresses our specific circumstances.*"
>
> **T6** expressed a common sentiment*: "Guidance on adapting CAPS content to our local context would be invaluable. We struggle to make some topics relevant to our rural learners.*"
>
> "*Practical workshops on conducting experiments with limited resources would be tremendously helpful,*" **T4** suggested. "*CAPS often assumes access to equipment we simply don't have.*"
>
> **T1** identified another area for development*: "More support on assessment strategies, especially for practical evaluations without proper lab facilities, would enhance our teaching.*"

These statements highlight the need for context-specific professional development tailored to the realities of rural science education. This echoes Bantwini and Msongelwa-Nkosi's (2015) research calling for more targeted teacher support in resource-constrained educational environments.

Classroom observations revealed the impact of these professional development gaps. In **T4**'s lesson on electrical circuits, the lack of proper equipment led to a largely theoretical discussion, where practical training in creating low-cost circuit demonstrations could have significantly improved the lesson's impact. **T6** was observed struggling to contextualise a lesson on industrial processes for rural learners, highlighting the need for training in adapting urban-centric curriculum content to rural contexts. These observations underscore the importance of aligning professional development initiatives with rural educators' actual needs and contexts, as emphasised by Msimanga & Lelliot (2021) in their study on science education in diverse South African contexts

## 6. Discussion of the Findings

The implementation of CAPS in Grade 7 Natural Sciences classrooms in rural Eastern Cape should ideally provide a standardised, high-quality science education experience. However, the findings of this study uncovered significant challenges and adaptations in the rural context. Viewed through the

lens of Bronfenbrenner's Ecological Systems Theory (Bronfenbrenner, 1979), these challenges can be understood as arising from interactions between various environmental systems, from the immediate classroom (microsystem) to broader sociocultural factors (macrosystem).

The study revealed that teachers employ various creative strategies to implement CAPS, adapting to resource constraints, language barriers, and assessment challenges. These findings align with the idea that curriculum implementation can vary significantly across different teaching contexts (Ramnarain & Hlatshwayo, 2018). From a Pedagogical Content Knowledge (PCK) perspective (Shulman, 1986), these adaptations demonstrate teachers' efforts to integrate their content knowledge with context-appropriate pedagogical strategies.

The study emphasised the importance of teacher adaptability in creating an effective science classroom environment that fosters productive learning and improved outcomes in Natural Sciences, despite resource limitations. Teachers demonstrated remarkable ingenuity in using locally available materials and the school environment to conduct practical lessons. This aligns with Mafugu and Mafora's (2020) observations on the resourcefulness of teachers in under-resourced schools. Such adaptations reflect teachers' PCK in action as they navigate the constraints of their ecological microsystem to deliver effective science education.

However, the study also highlighted that these adaptations, while commendable, often fall short of fully meeting CAPS requirements, particularly in terms of practical experiments and the use of technology in science education. This discrepancy can be understood as a tension between teachers' PCK and the expectations set by the curriculum (part of the exosystem in Bronfenbrenner's model).

Resource constraints emerged as a significant challenge in CAPS implementation. The lack of laboratory equipment and basic scientific materials compromised the quality of practical work and, by extension, the depth of scientific understanding that learners could achieve. This situation echoes concerns raised by Msimanga and Lelliot (2021) about the equity of science education in South African schools. While teachers improvised with locally available materials, the absence of standard scientific equipment limited learners' exposure to precise scientific processes and measurements, potentially impacting their preparedness for higher levels of science education. These resource limitations represent a critical aspect of the microsystem that significantly influences teachers' ability to apply their PCK effectively.

Language emerged as another critical factor influencing CAPS implementation. The study revealed that teachers frequently resort to code-switching between English and isiXhosa to facilitate understanding. While this practice enhances immediate comprehension, it raises questions about the long-term impact on learners' scientific language development. Ferreira and Schulze (2018) also noted a concern in their study on multilingual science classrooms. From an ecological systems perspective, this language challenge represents an interaction between the microsystem (classroom language practices) and the macrosystem (broader linguistic and cultural context of the Eastern Cape).

Assessment practices in these rural classrooms showed significant departures from CAPS guidelines, largely due to resource constraints and large class sizes. Teachers adapted by using peer assessment strategies and simplified practical tasks, which, while innovative, may not fully align with CAPS assessment standards. This situation reflects Smith and Gorard's (2010) concerns about the effectiveness of assessment systems in resource-constrained environments. These adaptations demonstrate teachers' PCK in creating alternative assessment methods suited to their context but also highlight the challenges in aligning these practices with standardised curriculum expectations.

The study revealed a pressing need for targeted professional development for rural science teachers. Teachers demonstrated a willingness to implement CAPS effectively but lacked the specific skills and knowledge to do so within their resource-constrained environments. This aligns with Bantwini and

Msongelwa-Nkosi's (2015) findings on the professional development needs of rural teachers. From a PCK perspective, this highlights the need for professional development that enhances teachers' ability to integrate content knowledge with effective pedagogical strategies suitable for rural contexts. In Bronfenbrenner's model, such professional development represents an exosystem factor that could significantly influence classroom practices.

While there is a general acceptance of CAPS among teachers, the study uncovered a lack of comprehensive support for its implementation in rural contexts. The absence of tailored resources, professional development, and infrastructure support raises concerns about the equity and effectiveness of CAPS in rural schools. This situation calls for a reevaluation of how CAPS is supported and implemented in rural areas, echoing Masinire et al.'s (2021) call for more contextualised approaches to curriculum implementation in diverse South African settings. This need for contextualisation aligns with both PCK and ecological systems perspectives, recognising the importance of adapting educational approaches to specific environmental and pedagogical contexts.

In light of these findings, it is crucial that educational policymakers and departments consider a more flexible and supportive approach to CAPS implementation in rural schools. This could involve developing rural-specific resources, providing targeted professional development, and adjusting assessment practices to better fit rural contexts while maintaining educational standards. Such an approach would align with Nkambule and Mukeredzi's (2017) recommendations for bridging the gap between policy and practice in rural education. It would also represent a more ecologically valid approach to curriculum implementation, acknowledging the complex interplay between teachers' pedagogical knowledge and skills and the multi-layered context of rural education.

## 7. Limitations of the Study

This study has valuable insights, but it also has certain limitations that should be acknowledged. The research focused on only two rural schools in the Eastern Cape, which may not fully represent all rural schools in the province or country. As a result, the findings cannot be easily generalised to the broader context of rural education in South Africa due to the limited sample size. Furthermore, the timing of the study during the academic year may have influenced the types of lessons observed and the challenges reported by teachers. The data collected could have been impacted by seasonal variations in school activities and resource availability. Despite these limitations, the study's collection of rich, in-depth data provides valuable insights into the experiences of grade 7 Natural Sciences teachers implementing CAPS in rural Eastern Cape schools. While these findings may not apply universally, they still offer important perspectives that can inform further research and policy considerations for science education in rural South Africa.

## 8. Conclusion and Recommendations

This study aimed to explore the implementation of CAPS in Grade 7 Natural Sciences classrooms in rural Eastern Cape schools. The focus was on teachers' experiences and adaptations. Based on the findings from the literature and data, it is evident that while CAPS provides a comprehensive framework for science education, its implementation in rural contexts faces significant challenges. Teachers demonstrate remarkable creativity in adapting CAPS to their resource-constrained environments, but these adaptations often fall short of fully meeting curriculum requirements. The study revealed several key challenges, including severe resource limitations, language barriers, and difficulties in conducting prescribed practical work and assessments. These challenges significantly impact the quality and consistency of science education in rural areas, potentially widening the educational gap between rural and urban learners. However, the study also highlighted the resilience and ingenuity of rural teachers in creating meaningful learning experiences despite these constraints. The creative adaptations and persistent challenges observed in this study highlight both the resilience of rural teachers and the systemic issues in implementing a standardised curriculum across

diverse contexts.Addressing these challenges requires a multi-faceted approach that considers the unique needs of rural schools, supports teacher innovation, and ensures equitable access to quality science education for all learners, regardless of their geographical location. By integrating insights from PCK and Ecological Systems Theory, we can develop more comprehensive and context-sensitive strategies for supporting CAPS implementation in rural schools, ultimately working towards more equitable and effective science education in South Africa.

Based on the conclusion, this study proposes the implementation of adaptive strategies to enhance CAPS effectiveness in rural Grade 7 Natural Sciences classrooms. The study recommends capacity-building through context-specific, continuing professional development for science teachers. It suggests that the Department of Basic Education (DBE) focus on building teacher capacity to effectively incorporate CAPS in resource-constrained environments, addressing the unique challenges of rural science education. This should include training on adapting curriculum requirements to local contexts while maintaining educational standards.

The study also recommends that the DBE provide relevant physical science resources and facilities to benefit both teachers and learners in rural schools, making quality science education a reality. Where full laboratory setups are not feasible, the development of portable science kits tailored to the rural context is suggested. Additionally, the study recommends that the DBE develop bilingual science materials to support language transitions and more flexible assessment guidelines that acknowledge resource limitations while maintaining rigorous standards.

Furthermore, the study proposes engaging local communities to incorporate indigenous knowledge, establishing teacher networks for sharing best practices, and integrating appropriate technology solutions where possible. Finally, the development of a rural-specific CAPS addendum is recommended to provide guidance on implementing the curriculum in resource-limited contexts without compromising core learning objectives. These measures aim to enhance the quality of science education in rural areas, helping to close the educational gap and ensure all learners have the opportunity to develop strong foundations in science, regardless of their geographical location.

## 8.1 Implications of the study and research practice

The implementation of CAPS in rural Grade 7 Natural Sciences classrooms has practical implications for teaching practices, learners' experiences, and future research. This study enhances teaching practices in Natural Sciences by providing insights into how rural Grade 7 teachers adapt and implement CAPS in resource-constrained environments. Understanding their strategies and challenges can inform the development of more context-specific approaches to curriculum implementation, potentially leading to more effective and relevant science education in rural areas.

Additionally, this study can contribute to improving learners' learning experiences by understanding how teachers navigate the challenges of CAPS implementation in rural settings. The findings highlight the need for more culturally and contextually relevant science education, which can lead to increased engagement and better learning outcomes for rural learners. Teachers and policymakers can use these insights to develop more appropriate teaching materials, assessment methods, and practical activities that resonate with the rural context while meeting CAPS objectives.

Furthermore, the study's findings emphasise that Grade 7 Natural Sciences teachers in rural areas require additional support and training in several key areas. These include adapting CAPS requirements to resource-limited settings without compromising educational quality, integrating local knowledge and resources into the science curriculum to make it more relevant and engaging for rural learners, developing language support strategies to bridge the gap between home languages and scientific English, and creating and implementing alternative assessment methods that are suitable for rural contexts but still align with CAPS standards. These findings have implications for professional development programs and policy decisions regarding teacher support in rural areas.

Moreover, this study highlights the need for further research into the long-term impacts of adapted CAPS implementation on rural learners' scientific literacy and their progression in science education. Future studies could explore the effectiveness of the adaptive strategies identified and their impact on learners' academic performance and interest in science.

The study's findings also have implications for curriculum design and educational policy. They suggest a need for more flexibility in curriculum implementation guidelines, particularly for rural and under-resourced schools. This could lead to the development of a differentiated CAPS framework that maintains core learning objectives while allowing for context-specific adaptations.

Overall, this study not only sheds light on the current practices and challenges in implementing CAPS in rural Grade 7 Natural Sciences classrooms but also opens up new avenues for research, policy development, and practical interventions aimed at enhancing science education in rural South African schools. By addressing these implications, there is potential for significant improvement in the quality and relevance of science education in rural areas, ultimately contributing to better educational outcomes and increased scientific literacy among rural learners.

## 9. Declarations

**Funding:** This research did not receive any external funding.

**Acknowledgements:** There are no acknowledgements to make whatsoever.

**Conflict of Interest:** The author declares no conflict of interest.

**Data Availability:** The data supporting the findings of this research can be obtained upon request from the corresponding author. While the data is included in the article, ethical guidelines obtained for the study prevent its public accessibility to uphold confidentiality between the authors and participants.

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