



THE ROLE OF EDUCATIONAL SUPPORT SYSTEMS IN INTEGRATING ENVIRONMENTAL EDUCATION INTO LIFE SCIENCES

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Abstract

Integrating Environmental Education into the Life Sciences curriculum is crucial for fostering environmental literacy and promoting sustainable development. This study explores the role of educational support systems—including policy documents, textbooks, and subject advisors—in facilitating Environmental Education (EE) integration in the Vhembe District of South Africa. Guided by Bronfenbrenner’s Ecological Systems Theory, the research adopts a qualitative, phenomenological case study approach, utilizing document analysis and semi-structured interviews with Life Sciences teachers and a subject advisor. The findings reveal significant gaps in the instructional support provided by resources such as the Curriculum and Assessment Policy Statement (CAPS), textbooks, and pacesetters. These foundational materials lack explicit strategies for effective EE integration. Additionally, subject advisors face challenges in offering specialized support due to systemic constraints, including a focus on general curriculum goals and limited resources. This study underscores the urgent need for a cohesive and comprehensive approach to EE integration. Key recommendations include the development of targeted instructional resources, enhanced professional development for educators, and better coordination between policy and implementation. These measures are essential for equipping educators to deliver meaningful Environmental Education, enabling learners to address critical environmental challenges and contribute to sustainable development.

Key Words: *Environmental Education, Life Sciences, Educational support systems, integration*

1. Introduction

Environmental Education (EE) is crucial for addressing global environmental challenges such as climate change, pollution, and biodiversity loss. Its primary aim is to enhance environmental awareness, promote critical thinking, and encourage sustainable behaviours, thereby contributing to sustainable development (Gebrekidan & Gebremedhin, 2024). According to Sikhosana (2022), equipping individuals with the knowledge and skills to understand and address environmental challenges positions EE as a cornerstone for achieving sustainability. However, integrating EE into educational curricula remains a significant challenge, requiring intensified efforts to meet evolving environmental demands.

In South Africa, EE is embedded within the Curriculum and Assessment Policy Statement (CAPS), which mandates the inclusion of environmental topics across various subjects, including Life Sciences. This policy aims to equip learners with essential knowledge and skills to address environmental challenges, fostering critical thinking and sustainable practices (DBE, 2011). Despite this, the effective implementation of EE in the Life Sciences curriculum is hindered by several factors, including limited resources, insufficient teacher training, and inconsistencies between policy directives and classroom practices (Sikhosana, 2022).

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Life Sciences, with its focus on ecological systems, biodiversity, and human-environment interactions, offers an ideal platform for integrating EE. Aligning Life Sciences education with CAPS and international frameworks like the United Nations Sustainable Development Goals (SDGs) can significantly advance the development of environmentally literate individuals capable of engaging in sustainable practices and addressing both local and global environmental issues. Nevertheless, overcoming persistent challenges such as undefined pedagogical strategies, resource constraints, and inadequate professional development opportunities for educators remains critical to achieving meaningful EE integration (Khademi-Vidra, 2017).

Problem Statement

Environmental Education (EE) is globally recognized as a vital tool for advancing sustainable development, with UNESCO (2020) advocating for its mandatory inclusion in school curricula worldwide by 2025. In South Africa, the integration of EE is guided by the Curriculum and Assessment Policy Statement (CAPS). However, challenges such as inadequate teacher training, limited educational resources, and the lack of well-defined implementation strategies hinder its effective incorporation into the curriculum (Sikhosana, 2022; Mokhele, 2011; Damoah & Omadon, 2022). These barriers align with findings from both local and international research, highlighting teachers' limited capacity to integrate EE effectively due to gaps in environmental knowledge, pedagogical skills, and time constraints (Damoah & Adu, 2019; Corpuz et al., 2022; Abendan et al., 2023).

Although CAPS emphasizes the importance of EE, its practical implementation remains inconsistent. Many educators struggle to align EE with broader curriculum objectives, a challenge exacerbated by insufficient professional development opportunities and inadequate support networks within schools (Lotz-Sisitka et al., 2016). Additionally, teachers often lack the resources and guidance needed to incorporate EE effectively, resulting in missed opportunities to develop students' environmental knowledge, skills, and attitudes (Mbah & Ezegwu, 2024; Damoah & Adu, 2022). Successfully embedding EE into the Life Sciences curriculum requires strong support from educational systems, including comprehensive teacher training, clear curriculum guidelines, and adequate resources. Without these, EE's potential to shape learners' attitudes and behaviours remains limited. This study investigates ways to enhance support mechanisms, such as national policies like CAPS, Pacesetters, and textbooks, alongside the role of subject advisers, to strengthen EE integration in the Vhembe District.

Research Questions

- How do policy documents and textbooks facilitate the integration of Environmental Education into the Life Sciences curriculum?
- What is the role of subject advisors in assisting Life Sciences teachers with incorporating Environmental Education into their lessons?

3. Literature Review

Global and National Perspectives on Environmental Education

The integration of Environmental Education (EE) is a global effort aimed at equipping individuals to address pressing environmental challenges. Youth is widely recognized as a critical phase for fostering environmental responsibility and stewardship, as values and behaviours developed during this period often persist into adulthood (Abendan et al., 2023). The urgency to address global environmental crises such as climate change, biodiversity loss, and pollution has heightened the need for robust EE programs that provide learners with the knowledge, critical thinking, and problem-solving skills necessary for informed decision-making (Uy et al., 2023; Kilag et al., 2023).

Globally, several key policies underscore the importance of embedding EE into educational systems to promote sustainability and environmental awareness. These include the 1977 Tbilisi Declaration, the Belgrade Charter (1975), Agenda 21 (1992), the Earth Charter (2000), the 2030 Agenda for Sustainable Development, the Paris Agreement (2015), and the Global Action Programme



on Education for Sustainable Development (2015–2019) (UNESCO, 2020). As a result, many countries have incorporated EE into their national curricula. For instance, India has upheld a National Policy on Education since 1986, laying the groundwork for contemporary environmental education in schools (Vasistha, 2010). In Africa, the development of EE aligns with the continent's evolving environmental policies. In Nigeria, early environmental legislation, such as the Forest Ordinance of 1937 and the Criminal Code of 1958, aimed to regulate waste management, water pollution, and resource utilization (Erhabor & Don, 2016; Aladejebi, 2020). Tanzania's focus on EE began in the 1960s and gained momentum in the 1990s, driven by global sustainability initiatives and the need to address critical environmental challenges, including drought, inadequate sanitation, and pollution (Kimaro, 2018; URT, 2004).

In South Africa, EE efforts began in the 1960s and gained prominence with the adoption of the Belgrade Charter and Tbilisi Principles in the 1970s. Key milestones included the founding of the Environmental Education Association of Southern Africa (EEASA) in 1982 and the development of the Environmental Education Policy Initiative (EEPI) in 1992. These efforts culminated in the inclusion of EE in the Revised National Curriculum Statement (2005) and the Curriculum and Assessment Policy Statement (CAPS). However, despite its integration into various subjects, the absence of a dedicated EE curriculum limits its comprehensive implementation. This challenge mirrors global trends, where curriculum constraints and inadequate teacher training often impede the effective delivery of EE (Loubser et al., 2014; De Lange, 2004; Alam, 2023).

Educational Support Systems and Challenges in Environmental Education Integration

The integration of Environmental Education (EE) into contemporary curricula often employs interdisciplinary approaches, blending environmental themes with subjects like science, social studies, and geography (Hendriawan & Maulia, 2020). This approach highlights the transdisciplinary nature of environmental challenges, fostering a holistic understanding among learners. However, several barriers hinder its effective implementation, including inadequate teacher training, resistance from stakeholders, and inconsistency in program quality (Guo, 2020; Kopnina, 2014). Teacher training and professional development are crucial to equipping educators with the knowledge and skills required to effectively deliver EE. Unfortunately, many schools face resource constraints that limit access to these opportunities (Kopnina, 2014). Additionally, some stakeholders, such as parents and students, may resist the integration of EE, viewing it as an unnecessary addition rather than a core component of the curriculum (Kopnina, 2014).

The use of technology and multimedia tools has emerged as a potential solution to some of these challenges. Digital platforms, virtual simulations, and access to real-time data provide innovative ways to engage students with environmental topics, increasing the relevance and accessibility of EE (Kilag et al., 2023). Subject advisors play a critical role in supporting educators by providing curriculum guidance, facilitating professional development, and offering resources to enhance teaching practices (Mdabe, 2019; Ngcobo, 2020). They monitor and evaluate instructional practices, ensure policy implementation, and address challenges such as student engagement and diverse learning needs, contributing to improved educational outcomes.

Theoretical Framework: Bronfenbrenner's Ecological Systems Theory

This study applied Bronfenbrenner's Ecological Systems Theory to explore the interconnected influence of individual, social, and institutional systems on the integration of Environmental Education (EE). At the microsystem level, teachers play a crucial role in delivering EE content; however, their effectiveness is highly dependent on access to adequate resources and specialized training. The mesosystem emphasizes the interactions among schools, families, and communities, which are vital for fostering a supportive environment conducive to environmental education (Bronfenbrenner, 1979). At the exosystemic level, external factors such as curriculum

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design, policy frameworks, and funding significantly shape schools' ability to implement EE programs. The absence of a dedicated environmental education curriculum in South Africa reflects systemic barriers that demand targeted policy interventions (Alam, 2023). The macrosystem encompasses cultural values, societal attitudes, and global initiatives like the Sustainable Development Goals (SDGs), which advocate for the integration of EE into education systems worldwide (UNESCO, 2020). This research framework investigates the dynamic interactions across these systems, offering insights into the challenges and opportunities influencing the integration of EE within the Life Sciences curriculum in the South African context.

4. Methodology

Research Design

This research adopted an interpretivist framework, emphasizing the understanding of subjective realities shaped by individual experiences and values (Bahari, 2010; Mohammed, 2016). A qualitative approach was utilized to gather data in the form of narratives, aiming to capture and interpret participants' perspectives (Mathenjwa, 2014). The study employed a phenomenological case study design to explore the support mechanisms available to Life Sciences teachers in the Vhembe District for integrating environmental education. This approach enabled the researcher to gain in-depth insights into participants' lived experiences and the contextual factors influencing their practices (Smith, Flowers & Larkin, 2009).

Participants

A combination of purposive and convenience sampling methods was utilized in this study. Three secondary schools from the Mutshindudi Circuit were selected based on their accessibility, while three Life Sciences teachers (one from each school) and one subject advisor were purposefully chosen. Although the sample size was limited, it was deemed sufficient for an in-depth exploration of the research context, without making generalizations beyond the specific setting.

Data Collection

Data were collected through document analysis and semi-structured interviews, selected for their ability to provide detailed and relevant information. Official documents, including the CAPS Grade 10-12 policy, textbooks, and pacesetters, were analysed to assess how they addressed the integration of environmental education. Semi-structured, one-on-one interviews were conducted with the teachers and subject advisor, providing a comfortable setting for participants to freely express their views and experiences.

Data Analysis

Thematic analysis was carried out following the six-step process outlined by Maguire and Delahunt (2017): familiarization, coding, theme identification, theme review, definition, and writing-up. Documents were first analysed to identify relevant codes, such as teaching methods, environmental education content, and time allocation. Interviews were transcribed, coded, and analysed to further refine themes. The findings were then analysed across the datasets to address the research question on the support provided to teachers for integrating environmental education.

Findings

The findings are based on document analysis and interviews with three Life Sciences teachers and one subject advisor. The study focuses on understanding how Environmental Education is integrated into the Life Sciences curriculum, the role of available resources, and the support provided by subject advisors in facilitating this integration.

Policy and Curriculum Resources

The examination of policy documents, including the CAPS document, textbooks, and pacesetters, reveals that while these resources offer some guidance, they present significant limitations



in helping teachers effectively incorporate environmental education into their curricula. The CAPS document emphasizes the importance of developing responsible citizens, stating that learners should cultivate 'an awareness of what it means to be a responsible citizen' (DBE, 2011:8). This aligns with the broader goal of fostering environmental awareness, as reflected in the Life Sciences textbook, which encourages students to assess the environmental consequences of their actions (Clitheroe et al., 2013).

However, teachers rely predominantly on the CAPS document for guidance on teaching methodologies. Participant 2 underscored the document's significance, noting:

"The CAPS is very much important and helps me to teach environmental education in Life Sciences, because it contains important concepts that Life Sciences teachers should focus on ... for example, if I am teaching biodiversity, there will be guidelines on how I should teach it and what to focus on."

While the CAPS document provides some guidance, pacesetters—another key resource—mainly outline topics, timelines, and assessment schedules, without offering specific pedagogical strategies for integrating environmental education. Participant 3 explained:

"I cannot really say it has guidelines on how to teach environmental education in Life Sciences because it only outlines the topic, then I have to go to the textbook in order to get guidelines and content to support me in teaching that topic."

To address these gaps, some teachers adopt an integrated approach, combining the CAPS document, pacesetters, and textbooks to guide their teaching. Participant 1 elaborated on this approach, explaining how they blend these resources to create a more cohesive and effective teaching strategy:

"I have to go to the pacesetter and see which topic I have to teach in which date, then I go to the CAPS document on how to teach that topic. Then I go to the textbook and make notes looking at the content and following the guidelines from the textbook, combining them with those from the CAPS document, then after that I go and teach."

This process illustrates how teachers are often required to navigate a range of resources to piece together an effective approach to integrating environmental education. While these resources offer a foundation, the absence of detailed and explicit guidance for environmental education integration continues to pose a significant challenge.

Role of Subject Advisors

The role of subject advisors in supporting the integration of environmental education is limited, with their focus primarily being reactive and performance driven. Participant 4 noted that subject advisors' support is often geared towards addressing learner outcomes, rather than proactively assisting teachers in integrating environmental education into their lessons:

"The problem is that when we look at the [DBE], it is results oriented. We do not look at the longer impact that we [make]."

This results-oriented approach limits subject advisors' ability to provide comprehensive support for integrating environmental education, as the emphasis is placed on immediate learner outcomes rather than long-term educational goals such as sustainability and environmental awareness. Additionally, support from subject advisors tends to focus more broadly on Life Sciences as a whole, rather than addressing environmental education specifically. Participant 4 explained:

"We go out there and support Life Sciences as a subject, not environmental education as a section."

This generalized approach limits the effectiveness of the support provided, as it fails to address the specific challenges teachers encounter when trying to integrate environmental education into their lessons. Furthermore, resource constraints exacerbate the difficulty of implementing environmental education effectively. Participant 4 mentioned:

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"We do not have specific resources for environmental education, but we do use general Life Sciences resources, which may touch on environmental education topics indirectly."

The absence of dedicated environmental education resources and the general nature of subject advisor support forces teachers to independently navigate the integration of environmental education, often relying on their own initiative and creativity.

Discussion

The findings of this study indicate that while policy documents like the CAPS (Curriculum and Assessment Policy Statement) and textbooks provide some guidance for integrating Environmental Education (EE) into the Life Sciences curriculum, significant gaps remain in the support they offer (DBE, 2011; Clitheroe et al., 2013). The CAPS document outlines overarching goals such as promoting responsible citizenship and environmental awareness, aligning with the broader aims of EE. However, it provides limited specific guidance or actionable strategies for educators to effectively integrate EE into their teaching. This observation aligns with Bopape, Mudau, and Msezane's (2021) study, which also highlighted the lack of detailed instructional guidelines within the CAPS framework. From a Bronfenbrenner perspective, the absence of clear, actionable guidance in policy documents presents a challenge for educators, who operate within the microsystem of their immediate teaching environment where explicit support is essential (Bronfenbrenner, 1979). Educators often rely on the CAPS document for general guidance but are left without detailed directives on how to incorporate environmental issues into their lessons. As Participant 2 noted, while the CAPS document identifies essential concepts such as biodiversity, it lacks specific pedagogical guidance on teaching EE. This gap forces educators to supplement the CAPS document with additional resources or to rely on their initiative, a practice that reflects the influence of the mesosystem, where teachers use available resources from their immediate environment to fill in the gaps (Sikhosana, 2022; Bronfenbrenner, 1979).

The study also found that textbooks, although containing some content related to environmental issues, do not adequately support the integration of EE from a pedagogical perspective (Clitheroe et al., 2013). Participant 3 pointed out that while textbooks provide subject content, they lack the specific teaching strategies required for a comprehensive approach to EE. The designated Life Sciences textbook prompts students to consider the environmental impact of their actions (Clitheroe et al., 2013), but the material is not organized in a way that facilitates the seamless integration of EE into the curriculum. From a Bronfenbrenner perspective, textbooks are a key component of the exosystem, influencing both educators' teaching methods and students' learning experiences (Bronfenbrenner, 1979). The absence of pedagogical strategies in textbooks reduces their effectiveness, requiring teachers to reconcile the content with their teaching methods (Damoah, 2019). Consequently, educators must augment textbooks with supplementary materials or apply creative strategies to make environmental topics more engaging and relevant, often drawing from their personal experiences within the mesosystem of the classroom environment.

Pacesetters, another essential resource, provide guidance on the topics, deadlines, and assessment schedules but fail to offer specific directions for integrating EE into lessons. Participant 3 noted that pacesetters provide a framework for the curriculum but lack the pedagogical detail necessary for integrating EE effectively (DBE, 2011). This leaves educators with the task of synthesizing the CAPS document, textbooks, and pacesetters, which often results in an approach to EE that is fragmented and inconsistent. From Bronfenbrenner's ecological theory, the role of pacesetters is situated within the mesosystem, where educators must merge various elements from their environment to create a cohesive approach to teaching. The absence of explicit instructional guidance on teaching EE limits the effectiveness of these resources (Damoah & Omodan, 2022), underscoring the interconnectedness of the various layers in Bronfenbrenner's model, as teachers must navigate and integrate influences from multiple sources.

The study also highlights that subject advisors play a limited and often reactive role in supporting the integration of EE. Subject advisors typically focus on achieving student outcomes and ensuring compliance with curriculum requirements (DBE, 2011). Participant 4 pointed out that the



focus of subject advisor support on results-driven goals restricts their ability to provide proactive and comprehensive guidance on integrating EE into lessons (Alam, 2023). This results-oriented approach reflects the macrosystem, where broader policies and societal expectations shape the role of subject advisors. The emphasis on short-term academic outcomes hinders subject advisors' ability to support long-term educational goals, such as fostering sustainability and environmental awareness. Additionally, support from subject advisors is generally provided for the Life Sciences curriculum as a whole, rather than focusing specifically on EE. Participant 4 explained that subject advisors assist Life Sciences educators more generally, rather than offering specialized guidance on incorporating environmental education. This generalized approach fails to address the specific challenges that teachers face when trying to integrate EE into their instruction. From a Bronfenbrenner perspective, this lack of targeted support highlights the disconnect between the microsystem (teachers' classrooms) and the broader systemic influences at the macrosystem level, which often fail to provide the tailored assistance that educators require (Bronfenbrenner, 1979).

Finally, the lack of dedicated resources for EE exacerbates the challenges faced by subject advisors. Participant 4 noted that subject advisors often rely on generic Life Sciences materials that may touch on environmental issues but do not offer focused support for EE (Alam, 2023). The absence of dedicated EE resources forces teachers to independently find ways to integrate environmental topics into their curricula, often without sufficient guidance or support. This issue can be understood within Bronfenbrenner's exosystem, where external factors, such as the availability of resources and support structures, significantly affect teachers' ability to implement effective teaching practices (Bronfenbrenner, 1979). The lack of specialized EE materials requires teachers to take initiative and use their creativity to address the deficiencies in available resources, further emphasizing the importance of resource availability within the broader system.

Recommendations

This study offers several recommendations to enhance the integration of Environmental Education within the Life Sciences curriculum in South Africa. It advocates for a comprehensive and coordinated approach to embedding environmental education, which includes developing specialized resources, offering targeted professional development for educators, and shifting the perceptions and support of environmental education among all stakeholders. Addressing these challenges is essential to ensure that environmental education is effectively incorporated into the curriculum, equipping learners with the knowledge and skills necessary to promote environmental sustainability.

Conclusion

This study concludes that the integration of Environmental Education into the Life Sciences curriculum in South Africa is hindered by several structural challenges. Despite the existence of policy frameworks such as the CAPS document, which provides a foundation for incorporating environmental principles, the integration of environmental education remains weak and inconsistent. While policy documents, textbooks, and pacesetters offer some guidance, they lack the comprehensive pedagogical strategies and resources needed for effective implementation. As a result, educators face significant challenges in integrating environmental education into their curricula, relying heavily on their own resources and methods to address gaps. The role of subject advisors is crucial but limited, as their support tends to be broad and not specifically tailored to environmental education. Coupled with resource constraints, this further complicates the integration process. The findings highlight the need for a comprehensive and unified approach to address these challenges. Bronfenbrenner's Ecological Systems Theory provides a valuable framework for understanding the interactions between the various systems influencing environmental education integration. At the microsystem level, teacher training and resource accessibility are key, while at the mesosystem level,

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stronger collaboration among teachers, schools, and subject advisors is essential for providing more focused and effective support.

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