



Examining the Integration of Environmental Education into Pedagogy by Educators

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Abstract

This research is aimed at providing an overview of the integration of environmental education into the senior phase curriculum. By examining the implementation process, teaching methods, and perceived outcomes, the study seeks to offer comprehensive insights into the effectiveness of incorporating environmental education at this educational level. The research involved three purposively selected senior-phase Natural Sciences, Technology, and Life Orientation educators. Using a multiple case study design and Bronfenbrenner's Ecological Systems Theory as an overarching theoretical framework, the study explores the alignment of environmental education with broader educational goals, the adversities faced, and the strategies employed by educators. Qualitative data were collected through interviews and classroom observations. The study revealed that educators encountered significant challenges in incorporating environmental education into the senior phase, including inadequate resources, time constraints within an already demanding curriculum, teacher preparedness, and the need for innovative assessment methods. It is recommended that an interdisciplinary curriculum framework be developed to seamlessly integrate environmental education into all existing subjects, ensuring the relevance of environmental issues in diverse contexts. Additionally, the Department of Basic Education should establish a specialized training program to equip educators with the necessary knowledge, skills, and pedagogical approaches for delivering effective environmental education, covering both content and instructional methods. The findings not only contribute to the local context but also provide valuable implications for enhancing the incorporation of environmental education across diverse educational settings.

Keywords: Environmental Education; Education for Sustainable Development; Integration, Teacher Knowledge

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1. Introduction

Since the 1960s, the primary goal of environmental education has been to cultivate citizens who are more engaged, informed, and committed to environmental issues (Sultan et al., 2016). Environmental education aims to positively transform individuals'

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environmental knowledge, ethics, awareness, attitudes, and behaviors, contributing to sustainable development by providing the necessary knowledge and skills to address global environmental challenges and promoting environmentally sustainable behaviors (Kadarisman & Pursitasari, 2023; Sukma et al., 2020). In South Africa, a country renowned for its rich biodiversity and complex ecological systems, the integration of environmental education into the formal education system has gained significance. This study seeks to examine the incorporation of environmental education into senior-phase teaching and learning in schools, as the senior phase is crucial for fostering learners' comprehensive understanding of the world and their roles as responsible citizens. Given the growing global importance of environmental issues, understanding how environmental education is integrated into formal education is essential for nurturing a generation of environmentally aware and proactive citizens. According to the United Nations Educational, Scientific, and Cultural Organization (UNESCO, 2021), educators play a critical role in educating learners about the environment, environmental education, climate change, sustainable development, and global citizenship.

Hence, several studies have examined educators' and students' understanding and attitudes toward the environment, environmental education, and Education for Sustainable Development (ESD). For example, Swarts et al. (2015) focused on how teachers can effectively incorporate environmental education in the foundation phase (grades R–3). Meanwhile, Mudaly and Ismail (2016) emphasized educator development in acquiring contextual knowledge of environmental and sustainability education. In contrast, Pauw and Petegem (2017) expanded their research to include the influence of environmental policy and the nature of school objectives and teaching methods. Similarly, Thor and Karlsudd (2020) concentrated on promoting environmental awareness activities to foster action-oriented environmental education, and Edsand and Broich (2020) evaluated how environmental education in schools could accommodate diversity in students' environmental literacy. These empirical studies were used to assess the integration of environmental education into the senior phase curriculum in three selected primary schools in Mpumalanga province, South Africa. Through examining the implementation process, pedagogical approaches, and perceived outcomes, comprehensive insights into the effectiveness of incorporating environmental education at this educational level were provided. As stated by the United Nations (2019), "The 2030 Agenda and the Sustainable Development Goals are our collective response to building a fair globalization," illustrating the weightiness of global sustainability discussions. Therefore, understanding the fundamental principles of environmental sustainability is crucial (Stone, 2017).

It is worth noting that environmental education plays a vital role in transforming and rethinking education to change human lives to achieve sustainability (UNESCO, 2018). This is because the world is facing various environmental issues, including pollution, deforestation, natural disasters, climate change, loss of biodiversity, and overpopulation

(Zaini & Ita, 2020). These environmental issues led to the establishment of World Environmental Education Day, during which schools, environmental education centers, and public institutions came together to develop educational actions (World Environmental Education Congress, 2018). Solutions to these environmental issues can be achieved through the acquisition of adequate knowledge about environmental education (Makokotlela, 2016). Therefore, it is important to raise awareness about environmental issues, as environmental education is already a part of the school curriculum and is integrated across all subjects. It is also crucial to examine the effectiveness of environmental education initiatives coordinated in South Africa (Makokotlela, 2016). Anecdotal evidence suggests that educators do not necessarily integrate environmental education in senior-phase teaching and learning. This professional deficiency can partly be attributed to the lack of a coherent and implementable plan to integrate environmental education in senior-phase teaching and learning in particular. Zaini and Ita (2020) highlighted educators' lack of knowledge about environmental education, while Velempini (2017) examined the incorporation of environmental education in the secondary school curriculum. McCrea (2006) posits that environmental education is broad by its very nature. These findings shed light not only on the effectiveness of integrating environmental education within the senior phase but also on the broader implications for educational policy and practice in South Africa and beyond. Given these practical considerations, this paper examined the integration of environmental education into pedagogy by educators. Bronfenbrenner's Ecological Systems Theory (1977), is an overarching theory that aims at exploration of how educators interact within their environments across various levels. The theory emphasizes the interconnectedness of individuals with their immediate surroundings, broader community and institutional influences, societal values and norms, and historical contexts.

1.1. Relevant scholarship

Instructional methodologies are employed by educators to assist students in developing strategic thinking and enhancing their critical thinking and problem-solving skills. These methodologies have the potential to foster autonomy and strategic thinking in both educators and students, while aiding students in acquiring knowledge about specific subject matter (Sikhosana et al., 2020). However, James (2012) highlighted that some educators may be reluctant to embrace innovative instructional practices. This assertion aligns with the findings of Zaini and Ita (2020), who noted that educators often encounter challenges when selecting teaching methods for integrating environmental education, potentially hindering their ability to incorporate environmental education into their teaching practices. Therefore, addressing these issues is crucial if we aim to achieve the United Nations' 2030 sustainable development goals related to environmental concerns. When designing an intervention strategy, it's important to first understand what

teachers do when they say they are integrating environmental education (Sikhosana et al., 2020). Several empirical studies have been conducted to explore different aspects of environmental education. For instance, Velempini (2017) focused on the impact and integration of environmental education in the secondary school curriculum, while Marty et al. (2022) delved into the historical underpinnings of environmental education, emphasizing the diverse and expansive roots of this field. Schoeman and Sanders (2019) examined the nature of environmental education using technological tools, and Hebe (2019) concentrated on the placement of environmental education in the South African school curriculum. Furthermore, Huang and Zheng (2022) investigated the relationship between teaching style and learning effectiveness, while Anyolo et al. (2018) explored teachers' perspectives on environmental education. Additionally, Sukma et al. (2020) studied the opinions and knowledge of educators regarding the integration of environmental education in primary schools. These studies are integral to the environmental education framework and are aligned with the global Sustainable Development Goal for quality education (DeSousa et al., 2017). Understanding the instructional methodologies employed by educators to integrate environmental education is therefore a crucial next step in this line of inquiry.

1.2. Theoretical framework

The integration of environmental education into the senior phase of learning is a critical area of focus as it aims to equip students with the knowledge, skills, and values necessary to promote environmental awareness and responsible citizenship. This study is grounded in Bronfenbrenner's Ecological Systems Theory (1977), providing the theoretical framework that underpins the exploration of how educators interact within their environments across various educational levels. The theory emphasizes the interconnectedness of individuals with their immediate surroundings, broader community and institutional influences, societal values and norms, and historical contexts. By applying this theory, an understanding of the multiple ecological layers that influence the incorporation of environmental education in the senior phase can be gained. This theoretical framework aims to offer a structured approach to comprehending the essential components and principles that support the effective integration of environmental education in the senior phase. It enables a comprehensive examination of the incorporation of environmental education, aiding educators in designing curricula, teaching methods, and assessments that encourage a holistic understanding of environmental issues, foster sustainable behaviors, and empower students to become environmentally conscious citizens.

1.3. Purpose of the study

The purpose of this study is to examine the integration of environmental education into pedagogy by educators into the senior phase curriculum, gain insight into educators' knowledge about environmental education, the adversities and prospects they face, the strategies employed by educators, and the impact on students' environmental awareness and actions. This is crucial for shaping students' knowledge, attitudes, and behaviors towards the environment (Sumarno & Setiadi, 2023). By examining the local context, pedagogical approaches, and stakeholders' perspectives, this research aims to contribute to both the academic discussion on integrating environmental education and the practical improvement of educational practices within the district under study.

1.4. Problem of the Study

The integration of environmental education into the senior phase is confronted with a multitude of challenges that impede its efficacious execution. These challenges emanate from a confluence of factors encompassing curriculum, resources, pedagogy, and institutional dynamics. Noteworthy impediments to the integration of environmental education in the senior phase, as discerned by Mashaba (2022), Sikhosana et al. (2020), Msezane & Mudau (2014), and Matshe (2001), include the following:

- **Insufficient Curriculum Alignment:** Environmental education may not be seamlessly embedded within the existing curriculum framework, posing difficulties for educators in identifying suitable junctures for integration without disrupting the overall structure (Mashaba, 2022).
- **Resource Constraints:** Environmental education often necessitates hands-on experiences, field trips, and requisites such as equipment and materials. Schools in resource-challenged locales may encounter difficulties in affording these opportunities, thereby resulting in a paucity of practical engagement (Msezane & Mudau, 2014).
- **Teacher Preparedness:** Not all educators may have undergone adequate training or possess a robust foundation in environmental education. This lack of readiness may impede their capacity to effectively integrate environmental topics into their teaching methodologies (Matshe, 2001).
- **Time Limitations:** Educators may perceive themselves as constrained by time constraints, owing to the packed curriculum and the necessity to cover sundry subjects. Undertaking a deep dive into environmental topics within this framework may thus prove arduous (Sikhosana, 2022).
- **Policy and Institutional Support:** The absence of unambiguous policies or institutional support for the integration of environmental education may impede the endeavors of educators and undermine the sustainability of such initiatives (Msezane & Mudau, 2014).

Addressing these challenges requires a multi-faceted approach involving curriculum redesign, teacher training, allocation of resources, policy adjustments, and community involvement. By acknowledging and working to overcome these obstacles, the integration of environmental education in the senior phase can be made more effective and impactful. Accordingly, this study is guided by the following main research question:

How do educators integrate environmental education into pedagogy?

To answer the main research question, the following sub-questions were formulated:

- What is the nature of educators' knowledge about environmental education?
- What are the adversities and prospects associated with the integration of environmental education into pedagogy?

2. Method

The qualitative research conducted followed a multiple case study design and interpretative research paradigm as proposed by Wahyuni et al. (2023). This approach allowed for a comprehensive contextual analysis of the cases and their interrelationships, in line with the perspective presented by McMillan and Schumacher (2014). Furthermore, the adoption of a multi-case study design facilitated the selection and analysis of multiple cases with both commonalities and differences, enhancing the depth and breadth of the study.

2.1. Participant (subject) characteristics, sampling method and sampling criteria

The research involved three educators teaching subjects such as Life Orientation, Technology, and Natural Sciences. The selection of participants followed the purposeful sampling approach outlined by Suen et al. (2014) to ensure the suitability of the chosen participants. The educators were selected based on the following criteria:

- Possession of a teacher's Diploma or Bachelor of Education qualification
- At least 5 years of teaching experience
- Specialization in any of the following subjects: Life Orientation, Technology, and/or Natural Sciences in the senior phase.

These criteria were essential to ensure that the participants could provide comprehensive and detailed information about the subject under investigation. Hence, the diverse criteria used in the selection of cases, such as typicality, diversity, replication, contrast, and theory testing, contributed to a robust research framework.

2.2. Data collection

Qualitative data was gathered through semi-structured interviews and classroom observations, aligned with the methods advocated by Doyle (2019). The utilization of open questions during interviews facilitated in-depth discussions, while the use of an observation protocol and audio recorder during lessons ensured comprehensive data collection. The non-participant observation approach enabled an unbiased perspective in observing the teachers' activities.

2.2.1. Data analysis

The data analysis consisted of two phases and was aligned with the research questions, themes, theoretical framework, literature review, and the researcher's personal experience. Each case was individually analyzed, and the data was coded and organized into categories and themes. The initial phase involved the researcher familiarizing oneself with the data through reviewing, reading, and listening to the audio recordings (Sari and El Islami, 2022). This facilitated the transcription of the verbatim interviews and the creation of a narrative based on observations. The data was categorized and listed for easy retrieval and access, then coded and grouped into a table for easier identification (Johnson et al., 2020). Coding enabled the researcher to structure data elements, categorize them, and summarize them. The second phase entailed becoming acquainted with recorded audio, interview transcripts, and field notes from observations.

2.2.2. Trustworthiness of qualitative data

To ensure the trustworthiness of the qualitative data, consistent open questions were posed during face-to-face interviews, in line with Nieuwenhuis (2016). Prolonged engagement and methodological triangulation, combining interviews and observations, were employed to enhance the credibility and trustworthiness of the data, drawing upon the principles outlined by Noble and Heale (2019). The study achieved rigor by triangulating data (Johnson et al., 2020) and maintaining credibility throughout the process (Guba & Lincoln, 2018). In this research, triangulation involves examining specific aspects from multiple perspectives (Fleck et al., 2014), accomplished by merging data, interview transcripts, and observational field notes. The analysis progressed from identifying simple themes to complex and then denser themes (Creswell, 2014). Credibility was enhanced through in-depth interviews and thorough observations (Guba & Lincoln, 2018). Creswell (2014) supports the idea that spending more time in the field enhances rigor. Therefore, the extended time spent at the research site allowed the researcher to gain a deep understanding of the school environment and culture.

2.2.3. Research setting

The research was conducted in the Nkangala District of the Mpumalanga Province in the Republic of South Africa, focusing on three primary schools' catering to students from

grade 7 to grade 9 which is the senior phase. This setting, within the broader context of the Mpumalanga Province, offered a rich and diverse environment for the study.

3. Results

The data was presented and discussed in a narrative format, with each case being addressed in separate paragraphs. Data collection involved interviews and classroom observations of three consecutive lessons for educators in the subjects of Life Orientation, Natural Sciences, and Technology. Additionally, findings were based on the data extracted from interview transcripts and classroom observations of the three educators. The key themes focused on were:

- Educator's environmental education knowledge
- Adversities and prospects of integrating environmental education

The results were organized based on the thematic patterns derived from the data analysis. To observe the ethics, the researcher used the following pseudonyms throughout the data presentation, discussion, and findings:

- Case 1: Mrs. Mzwezi, Life Orientation educator
- Case 2: Mr. Matodzi, Technology educator
- Case 3: Mr. Gaba, Natural Sciences educator

3.1. *Educator's Environmental Education Knowledge*

3.1.1 *Case 1: Mrs. Mzwezi, Life Orientation educator*

Mrs. Mzwezi demonstrated an incoherent understanding of environmental education. This incoherence in understanding is reflected in the following excerpt.

"Hmm... According to my understanding, the environment refers to the surroundings, the area encompassing your vicinity. Your classroom can also be considered as part of your environment."-Mrs. Mzwezi

Mrs. Mzwezi emphasized the importance of environmental education, focusing on the preservation of a healthy environment. When discussing the integration of environmental education into teaching and learning, Mrs. Mzwezi stressed the value of engaging students outdoors to observe and interact with the environment. Environmental education was incorporated during physical education sessions held on the outdoor sports field, as well as in classroom settings when addressing topics such as abuse. During physical education classes, Mrs. Mzwezi emphasized the significance of exercising in a safe environment and encouraged students to uphold cleanliness in their surroundings. When teaching about abuse, Mrs. Mzwezi shed light on various situations in which individuals may experience abuse depending on their environment, including

community, poverty, and unemployment. This approach provided a platform to raise awareness about real-life situations affecting individuals and the environment in the context of abuse.

3.1.2 Case 2: Mr. Matodzi, Technology educator

Environmental education meaning is important when one is attempting to comprehend how an educator integrates environmental education into pedagogy. When asked about environmental education, Mr. Matodzi indicated that it explained the concept as:

“The nature that we live in which accommodates living and non-living things.”-Mr. Matodzi

Mr. Matodzi indicated that environmental education is about creating awareness and developing a deeper understanding of the environment that we live in. He further stated that:

“When you integrate environmental education, you must ensure that you present lessons that are practically related to environmental education, if possible.”-Mr. Matodzi

It was noted that Mr. Matodzi seamlessly integrated environmental education into his lessons on building cell phone tower structures and various types of environments where pilot structures, headgear structures, and windmill structures can be found. Interestingly, Mr. Matodzi was not consciously aware of this, as he believed that environmental education could only be integrated through practical activities and school excursions. The researcher also observed that Mr. Matodzi incorporated environmental education into his Technology subject lessons when presenting a module on investigating cell phone towers. During this lesson, he demonstrated a keen awareness of environmental impact, particularly visual pollution caused by the construction of cell phone towers. As a result, the lesson enhanced the students' understanding of visual pollution.

3.1.3 Case 3: Mr. Gaba, Natural Sciences educator

In a discussion about environmental education, Mr. Gaba expressed that the definition of environmental education can vary depending on the specific topics he teaches. He emphasized that environmental education is influenced by our surroundings, whether they support life or not. Mr. Gaba added that:

“Environmental education is shaped by the specific surroundings in which we find ourselves. It is influenced by the presence or absence of life. The approach to this topic depends on the specific aspect that we are addressing.”-Mr. Gaba

Mr. Gaba emphasized that environmental education involves gaining an understanding of one's surroundings, learning how to responsibly care for the

environment, and developing the ability to identify and address environmental issues. In response to a question about his interpretation of incorporation, Mr. Gaba explained that integration entails examining various subjects to identify commonalities among them.

“For example, I can integrate science with mathematics by taking learners outside and organizing them into groups. I would ask them to form groups of five members, which involves working with numbers. Additionally, when we visit a dumping zone to sort materials, we will also be counting and integrating mathematics into our science lesson.”-Mr. Gaba

Moreover, Mr. Gaba emphasized that the incorporation of environmental education should not be limited to specific subjects with explicit environmental content and practical assessments. He demonstrated the integration of environmental education by delivering a lesson on recycling, addressing environmental issues such as pollution and poorly managed landfills. Through this lesson, he highlighted the significance of creating a sustainable environment to mitigate pollution. Mr. Gaba effectively connected the lesson on recycling to real-life environmental challenges, fostering a deeper understanding among students. For instance, he illustrated the involvement of elderly individuals in community recycling efforts, providing students with a tangible example of environmental issues within their surroundings.

3.2 Adversities and prospects of integrating environmental education

3.2.1 Case 1: Mrs. Mzwezi, Life Orientation educator

The integration of environmental education was consistent. The teacher indicated that she does not integrate environmental education all the time. The teacher further indicated that she only integrates environmental education depending on the lessons that she is teaching at a particular time. These sentiments are summarized in the following excerpt.

“I do not always integrate it, but sometimes I do, depending on the topic I am teaching. For instance, when teaching about rights, it is important to integrate environmental education because students need to understand how to take care of their environment.”-Mrs. Mzwezi

Overcrowding was highlighted as one of the factors that hinder the incorporation of environmental education in teaching and learning. In this regard, Mrs. Mzwezi asserted that:

“I believe that the main challenge is that classes are often overcrowded, and there is not enough time to incorporate environmental education. When you integrate environmental education, the students need to be outside, but the crowded classroom environment and lack of space makes it difficult to do so.”-Mrs. Mzwezi

Mrs. Mzwezi acknowledged that the integration of environmental education in pedagogy affords students meaningful opportunities to learn about sustainable environments. However, these opportunities can be harnessed when classes are manageable. Mrs. Mzwezi indicated the following:

“I believe there are opportunities to integrate environmental education into our manageable classes.”-Mrs Mzwezi

3.2.1 Case 2: Mr. Matodzi, Technology educator

Lack of learning material stifled meaningful incorporation of environmental education in pedagogy as reflected in the following excerpt.

“Sometimes we struggle with learning materials. When requesting the purchase of learning materials, there are occasional issues.”-Mr. Matodzi

In addition, educators’ inability to implement project-based learning stifled meaningful integration of environmental education in pedagogy. Materials such as wires, batteries, or bulbs that were needed to build the cell phone tower project but were not available. This impeded the integration of environmental education because Mr. Matodzi was not able to effectively raise awareness about the important specifications that should be evident when building a cell phone tower so that the environment can be protected.

Furthermore, the researcher observed that Mr. Matodzi had a limited number of textbooks for the Technology subject. This served as a challenge for the integration of environmental education in the lesson that he presented about different types of structures. He used a textbook as learning material, which was shared by more than five students. During lesson observations, the teacher was observed using pictures that were available in the textbooks when he taught about structures. This created an opportunity that allowed him to relate the lesson topic to real-life situations which enhanced his knowledge and understanding of the environment. Mr. Matodzi highlighted that:

“Yes, I believe it's crucial to incorporate Environmental Education. We live in the environment and face numerous environmental dangers of which we may be unaware. Moreover, learners need to understand the positive aspects of nature that may be misconstrued as negative.”-Mr. Matodzi

3.2.3. Case 3: Mr. Gaba, Natural Sciences educator

Lack of learning materials and school environment were some of the adversities that the educator experienced when he had to integrate environmental education. Mr Gaba stated that:

“Challenges are always present when integrating environmental education. There may be a lack of suitable material for class, hindering learners' understanding.

Additionally, school constraints may prevent the integration of education with the environment.”-Mr. Gaba

Mr. Gaba indicated that the usage of different learning environments could provide prospects for integrating environmental education as students could enhance better understanding of the lesson content presented. Mr. Gaba asserted that:

“We should consider real-world experiences in the classroom. Some students learn best through visual aids. So, by bringing real-world examples into the classroom, students can better relate and understand the topic.”-Mr. Gaba

Furthermore, Mr. Gaba indicated that it is important to integrate environmental education as there are prospects that could enhance the teaching and learning process. Mr. Gaba mentioned that:

“Opportunities are plentiful when learning is integrated, as it encourages learners to develop a love for learning and doing activities at home. For example, when discussing the environment, activities such as hand sorting and chromatography provide opportunities for learners to understand and be motivated to pursue similar activities in the future. They need to recognize the environmental impacts of such activities.”-Mr. Gaba

4. Discussion

4.1.1 Educator’s Environmental Education Knowledge

The research findings about the integration of environmental education in pedagogy by educators have yielded significant insights. There is clear evidence that the inclusion of environmental education at this critical stage yields a positive impact on learners' awareness, attitudes, and behavior towards the environment. The study highlights how such integration can function as a potent tool for fostering sustainable practices among future generations. It is established that educators' possession of knowledge shapes their attitude toward the environment (Noviana et al., 2019) and plays a crucial role in cultivating awareness about environmental protection (Kadarisman & Pursitasari, 2023). However, the study reveals that participating educators demonstrated insufficient knowledge about the environment. Ward et al. (2013) defined the concept of the environment as the surroundings and influences on a particular world or interest, while the Department of Environmental Affairs and Tourism (DEAT, 2004) defined it as the surroundings in which humans and other organisms exist. The educators also exhibited an inconsistent understanding of the concept of incorporation, a view not aligned with Makokotlela's (2016) articulate definition of incorporation. Their fragmented knowledge of environmental education is a concern, as the process is crucial for constructing knowledge, skills, values, and attitudes necessary for enhancing environmental

awareness and cultivating responsible environmental citizens (Adkins & Simmons, 2002).

Moreover, environmental education is essential for empowering individuals with problem-solving skills and the capacity to act to ensure the sustainability of the environment. However, educators expressed flawed views about the nature of their surroundings. Zafar (2018) defines environmental education as a holistic procedure aimed at creating responsible individuals who can identify environmental problems, engage in problem-solving, and act to protect the environment. The fragmented knowledge of the educators stifled meaningful incorporation of environmental education into teaching and learning, a process defined as creating awareness and understanding of environmental issues (Downey, 2016). Despite this, the Curriculum and Assessment Policy Statement stipulates that environmental education content should be integrated into all subjects and levels of the school system from Grade R to Grade 12 (Department of Basic Education, 2011). Hence, addressing this fragmentation should be a priority to enable educators to effectively integrate environmental education into teaching and learning.

4.1.2 Adversities and prospects of integrating environmental education

As the senior phase is densely packed with academic requirements and exam preparations, educators must establish effective instructional strategies. These strategies should provide clear explanations and applicable knowledge for learners, as well as compassionate and supportive interaction with them. According to Djami (2022), clear instructions and active participation from students are key components of effective teaching and learning. Integrating a new subject such as environmental education can be challenging due to time limitations, potentially leading to a reduced focus on the subject. Rahman et al. (2018) found that time constraints significantly impact teaching and learning, particularly when educators lack specialized training in environmental education. Fitriana et al. (2022) suggested that increasing students' motivation to protect the environment can contribute to reducing environmental damage. Traditional assessment methods may not fully capture the holistic learning outcomes of environmental education, as they may not measure attitudinal changes, behavior shifts, and practical applications. Adequate resources, including textbooks, materials, and equipment, are essential for impactful environmental education. However, schools that lack these resources find it challenging to provide comprehensive learning experiences. Zafar (2018) revealed that limited course handbooks, materials, and training on environmental education present significant challenges. Furthermore, without strong support from school administration and education policymakers, the incorporation of environmental education could be perceived as an additional burden rather than a valuable addition to the curriculum. Additionally, ensuring equal access to environmental education for all learners, regardless of their socioeconomic backgrounds

or learning abilities, poses a challenge, as some students may have limited access to outdoor experiences or lack prior exposure to environmental issues.

The integration of environmental education introduces students to real-world issues they are passionate about. It offers practical insights into topics such as climate change, sustainability, and biodiversity loss, thus making learning more pertinent and engaging. Environmental education naturally lends itself to interdisciplinary learning, enabling learners to understand the connections between various subjects and fostering a holistic comprehension of environmental challenges. Hands-on activities, field trips, and outdoor projects provide students with direct experiences of the environment, enhancing their understanding and sense of responsibility while supporting instructional strategies (Fitriana et al., 2022). Furthermore, environmental education can lead to positive behavioral changes, encouraging learners to embrace eco-friendly practices and ultimately cultivate a more environmentally conscious generation. By fostering an understanding of environmental issues, learners gain a global perspective and appreciate the importance of international collaboration in addressing environmental challenges (Djami, 2022). Integrating environmental education during the senior phase of schooling can have a lasting impact on learners, influencing their choices, careers, and contributions to society. Involving external stakeholders and local environmental organizations can enrich the learning experience by providing exposure to real-world experts and practical initiatives. Additionally, environmental education encourages critical thinking and problem-solving skills, nurturing a mindset of sustainability and inspiring creative thinking to address environmental issues. Ultimately, integrating environmental education during the senior phase curriculum prepares students to be informed and responsible stewards of the environment (Campbell & Chittleborough, 2014).

5. Conclusions

The integration of environmental education in pedagogy by educators is a significant and transformative undertaking, bearing extensive implications for both education and society. This research has examined the multifaceted terrain of integrating environmental education, uncovering its challenges, opportunities, and profound impacts on students' cognitive, attitudinal, and behavioral dimensions. The findings underscore the significance of equipping students with a comprehensive comprehension of environmental issues during this critical phase of their educational journey. The potential benefits arising from such integration are manifold and significant. By linking academic disciplines and real-world experiences, environmental education promotes interdisciplinary thinking, encouraging learners to recognize the intricate connections between ecological, social, and economic systems. Practical learning experiences, ranging from field trips to community engagement projects, not only enhance understanding but

also cultivate a sense of responsibility and agency. However, the path to successful integration is not devoid of challenges. Time constraints within an already rigorous curriculum, educator readiness, and the necessity for innovative assessment methods are all issues that necessitate attention. Furthermore, ensuring equitable access to environmental education, regardless of socioeconomic background or learning abilities, is essential to prevent perpetuating educational disparities. Positioned at the intersection of education, environment, and sustainability, this study reaffirms that environmental education is not simply an additional element in the curriculum, but a transformative influence that shapes informed and responsible citizens. By fostering an understanding of the fragility and resilience of our environment, we equip learners with the capacity to make conscientious decisions, both as individuals and as members of a global community. In sum, the integration of environmental education into senior-phase teaching and learning presents a promising prospect. It urges us to bridge the divergence between classroom learning and the external world, cultivating a generation of critical thinkers, problem-solvers, and proponents who possess not only knowledge but also a profound reverence for the complex web of life that sustains us all. This study lays the groundwork for a more sustainable future, where education acts as a catalyst for positive change and stewardship of our planet.

Recommendations

In the study focused on integrating environmental education in pedagogy by educators, various recommendations have emerged to enrich the effectiveness of this transformative approach:

- Developing interdisciplinary curriculum frameworks is essential for seamlessly integrating environmental education into existing subjects such as science, social studies, and literature. This integrated approach emphasizes the relevance of environmental issues in diverse contexts.
- Establishing specialized training programs is crucial to equip teachers with the necessary knowledge, skills, and pedagogical approaches for delivering effective environmental education. These programs should encompass both content and instructional methods.
- Incorporating practical and experiential learning opportunities, such as field trips, outdoor projects, and community engagement initiatives, is essential. These experiences provide tangible connections to real-world environmental challenges.
- Fostering collaborations with external stakeholders, such as local environmental organizations, government agencies, and community groups, is recommended. These partnerships enrich learning experiences and offer students exposure to real-world experts.

- Advocating for the inclusion of environmental education in educational policies and curriculum standards and collaborating with educational institutions and policymakers to emphasize the significance of this incorporation is essential.

By embracing these recommendations, educational institutions can harness the immense potential of integrating environmental education in the senior phase. By nurturing environmentally literate and conscious individuals, we contribute to a more sustainable future while equipping students with the knowledge and skills to address the pressing environmental challenges of our time.

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