

Assessment of Challenges and Practices in Integrating Sustainable Development into Biology Education

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ABSTRACT

The integration of sustainable development concepts into biology education is critical for preparing students to address environmental challenges and contribute to sustainable solutions. This study assesses the challenges and practices associated with integrating sustainable development into biology education, focusing on biology educators in Lagos State, Nigeria. A survey research design was employed, with data collected from 88 biology teachers in public senior secondary schools. The findings reveal a moderate level of engagement among educators in incorporating sustainability concepts, with diverse teaching methods and collaborative efforts being emphasized. However, significant challenges such as time constraints, inadequate resources, and resistance from stakeholders hinder effective integration. Despite these obstacles, educators demonstrate enthusiasm for teaching sustainability and recognize its importance. The study underscores the crucial role of educators' attitudes in driving effective integration and highlights the need for enhanced resources, institutional support, and collaboration opportunities to empower biology educators in promoting sustainability education. By addressing these challenges and building on promising practices, educators can better prepare students to address environmental challenges and contribute to sustainable solutions in the 21st century. This research contributes to the ongoing dialogue on sustainability education and informs efforts to enhance the effectiveness of biology instruction in fostering a culture of sustainability among students.

Keywords: Sustainable development, Biology education, Integration, Challenges, Attitudes.

INTRODUCTION

The idea of sustainable development was first presented in the Brundtland Report by the United Nations World Commission on Environment and Development (Brundtland *et al.*, 1987). Since then, it has become increasingly important in tackling the complicated problems that humanity faces in the twenty-first century. Development that satisfies current demands without jeopardizing the capacity of future generations to satisfy their own needs is referred to as this. According to Filho *et al.* (2018), the pursuit of sustainable development has become vital due to growing worries about environmental degradation, social inequality, and economic instability. As education has a critical role in forming beliefs, attitudes, and behaviors toward sustainability, Hogan & O'Flaherty (2021) assert that education is acknowledged as a vital tool for achieving sustainable development goals. Given its emphasis on biodiversity, ecological systems, and the interdependence of all species on Earth, biology education is especially important in this setting.

Building on the understanding that education is a vital instrument for accomplishing sustainable development goals, it is imperative to investigate the ways in which these ideas are incorporated into particular educational contexts, especially biology education. For students to be prepared to become knowledgeable and responsible citizens who can address environmental concerns and contribute to sustainable solutions, sustainable development concepts must be incorporated into biology instruction (Pamuk *et al.*, 2022). Nonetheless, it's important to evaluate how well biology teachers are using these ideas to their lesson plans. To identify areas for improvement, potential roadblocks to successful implementation, and strong points in biology educators' existing integration of sustainable development principles, it is imperative to have a thorough understanding of these methods.

When it comes to incorporating sustainable development themes into their lessons, biology educators around the world use a variety of approaches (Desa *et al.*, 2022; Hadi *et al.*, 2022). These approaches include fieldwork, project-based learning, and curriculum customization. Some educators emphasize ecological concepts, biodiversity, and conservation while skillfully integrating sustainability issues into already-existing biology courses. Others create practical assignments that let students investigate topics related to ecosystem dynamics, climate change, and habitat restoration. Students are exposed to environmental concerns and solutions firsthand through field trips, outdoor labs, and ecological fieldwork (Jeronen *et al.*, 2016).

Biology teachers encounter a number of challenges when integrating sustainable development themes into their lessons, despite their best efforts. Parry and Metzger (2023) list these barriers as a lack of environmental science training, time constraints resulting from the need to cover core biology content, difficulties evaluating sustainability competencies, and resistance to change from stakeholders who see sustainability education as a divergence from conventional biology instruction. Addressing these challenges is essential to fostering a more successful integration of sustainability into biology education. According to Jeronen *et al.* (2016), biology teachers can improve their teaching of sustainability by utilizing a variety of tools and support systems. Teachers can get useful tools and methods from curriculum guides, professional development opportunities, cooperation networks, and teaching resources centered around sustainability issues. It is essential to comprehend the sufficiency and accessibility of these materials in order to assist teachers in incorporating sustainable development into biology lessons.

Teachers that are dedicated to sustainable methods also set a strong example for their students, which emphasize the significance of sustainability in biology instruction. Research on the practices, difficulties, and attitudes of teachers, particularly those in Lagos State, is lacking despite the literature's current discussion on the practices and challenges of integrating sustainable development. Therefore, this research aims to assess the challenges and practices associated with integrating sustainable development into biology education. By examining the current landscape and identifying opportunities for improvement, this study seeks to contribute to the ongoing dialogue on sustainability education and inform efforts to enhance the effectiveness of biology instruction in promoting environmental literacy and fostering a culture of sustainability among students.

Research questions

1. What are the current practices of biology educators in integrating sustainable development concepts into their teaching practices?
2. What challenges do biology educators face when attempting to integrate sustainable development concepts into their teaching practices?
3. What resources and support are available to biology educators for teaching sustainability concepts in the classroom?
4. What are the attitudes of biology educators towards teaching sustainable development concepts, and how do these attitudes impact their instructional strategies?

METHOD

A survey research design was employed to assess the challenges and practices in integrating sustainable development into biology education. Surveys are a widely used method for collecting data from a large population, allowing for the systematic gathering of information on attitudes, behaviors, and perceptions. A non-probability sampling technique, specifically convenience sampling, was utilized to select participants for the study. Convenience sampling was chosen due to its practicality and accessibility, as it allows researchers to obtain data from individuals who are readily available and willing to participate. The population included all biology teachers in public senior secondary schools in Lagos State. The data were collected using a Google form survey questionnaire. Google forms provided a convenient and efficient platform for administering the survey electronically, allowing participants to respond at their convenience. The questionnaire was designed to

gather information on the challenges encountered and the practices employed by biology educators in integrating sustainable development concepts into their teaching. The sample consisted of 88 respondents, representing a diverse range of biology educators in Lagos State. To ensure the reliability of the survey instrument, the internal consistency of the questionnaire items was assessed using Cronbach's alpha coefficient. A reliability coefficient of 0.80 was obtained, indicating high internal consistency and reliability of the survey instrument. This suggests that the survey items consistently measured the constructs of interest. Descriptive statistics were employed to analyze the data collected through the survey. Descriptive statistics provide a summary of the characteristics of the sample and the responses to survey items, including measures of central tendency, variability, and frequency distributions.

RESULTS

Research question one: What are the current practices of biology educators in integrating sustainable development concepts into their teaching practices?

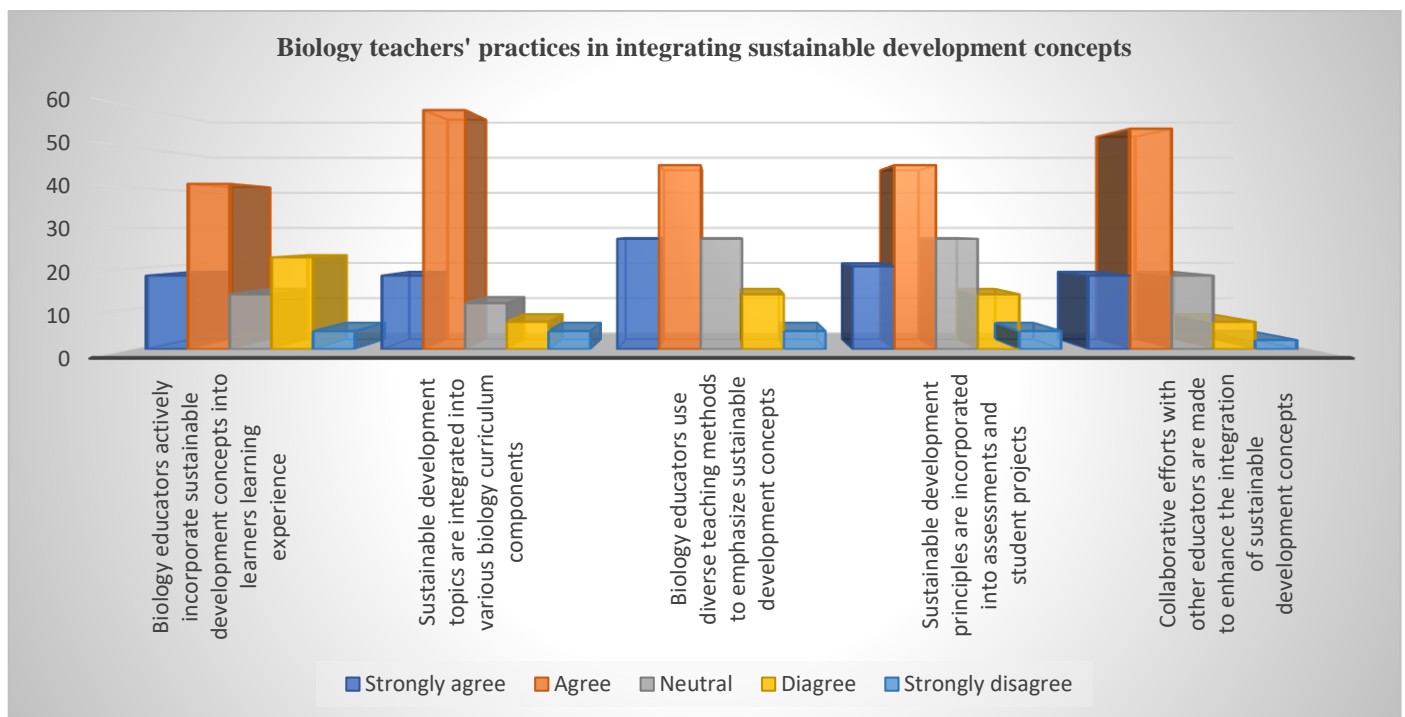


Figure 1: Current practices of biology teachers in integrating sustainable development concepts into their teaching practices

The results from Figure 1 provide insights into the current practices of biology educators regarding the integration of sustainable development concepts into their teaching practices. The data indicate a moderate level of engagement in incorporating sustainability into the learning experience, with approximately 40.9% of educators indicating agreement (SA) and 22.7% indicating disagreement (D). Similarly, sustainable development topics seem to be moderately integrated into various biology curriculum components, with 59.1% of educators agreeing (A) and 6.8% disagreeing (D). However, there appears to be a stronger emphasis on using diverse teaching methods to highlight sustainable development concepts, as indicated by the highest percentage of educators agreeing (47.7%) compared to other items. Notably, collaborative efforts with other educators to enhance integration receive relatively high agreement (54.5%), suggesting a recognition of the importance of teamwork in promoting sustainability education. These findings suggest that while there is a notable effort among biology educators to integrate sustainable development concepts, there is room for improvement, particularly in aligning teaching methods and assessments more closely with sustainability principles.

Research question two: What challenges do biology educators face when attempting to integrate sustainable development concepts into their teaching practices?

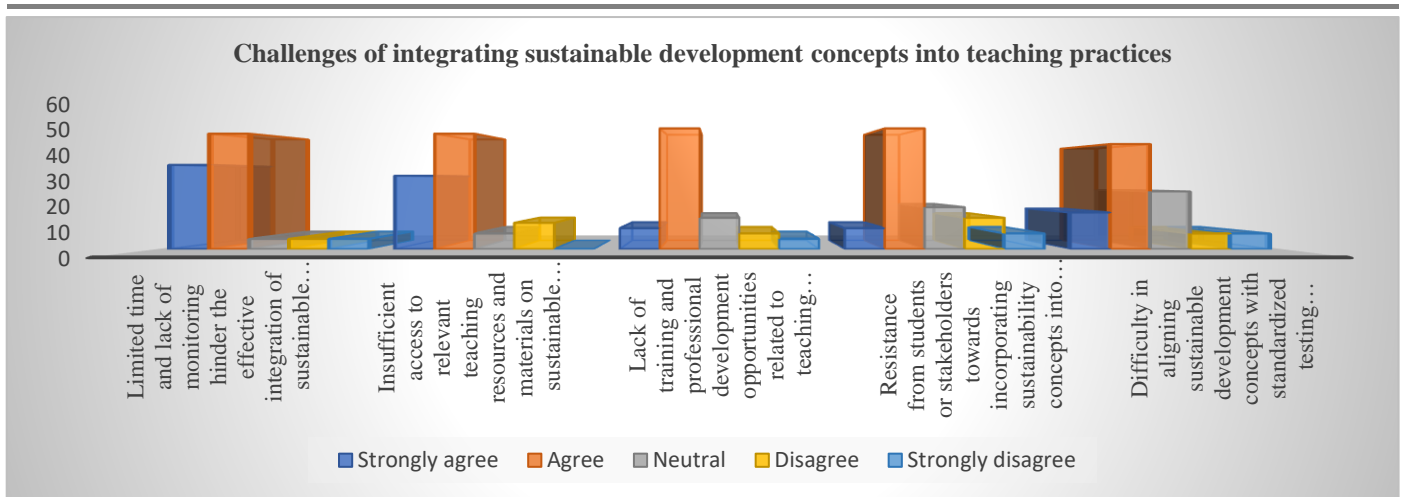


Figure 2: Challenges of integrating sustainable development concepts into teaching practices

The findings from Figure 2 shed light on the challenges encountered by biology educators when endeavoring to integrate sustainable development concepts into their teaching practices. Firstly, a significant proportion of educators express concerns regarding limited time and lack of monitoring, which hinder the effective integration of sustainable development, with 36.4% strongly agreeing and 50.0% agreeing. This indicates that time constraints and inadequate monitoring mechanisms pose substantial barriers to the successful integration of sustainability into teaching practices. Moreover, insufficient access to relevant teaching resources and materials on sustainable development topics emerges as another prominent challenge, with 31.8% strongly agreeing and 50.0% agreeing. This highlights the importance of ensuring educators have access to comprehensive resources to support their integration efforts. Additionally, a considerable percentage of educators identify the lack of training and professional development opportunities related to teaching sustainability as a significant obstacle, with 9.1% strongly agreeing and 52.3% agreeing. This underscores the need for targeted training initiatives to enhance educators' capacity in this area. Furthermore, resistance from students or stakeholders towards incorporating sustainability concepts into the curriculum is perceived as a notable challenge, with 9.1% strongly agreeing and 52.3% agreeing. This resistance underscores the importance of addressing misconceptions and garnering support for sustainability education initiatives. Lastly, difficulty in aligning sustainable development concepts with standardized testing requirements presents a considerable hurdle, with 15.9% strongly agreeing and 45.5% agreeing. This suggests a need for alignment strategies to ensure that sustainability concepts are effectively integrated without compromising curriculum standards. These findings highlight the multifaceted challenges faced by biology educators in integrating sustainable development into their teaching practices, necessitating targeted interventions and support mechanisms to address these barriers effectively.

Research question three: What resources and support are available to biology educators for teaching sustainability concepts in the classroom?

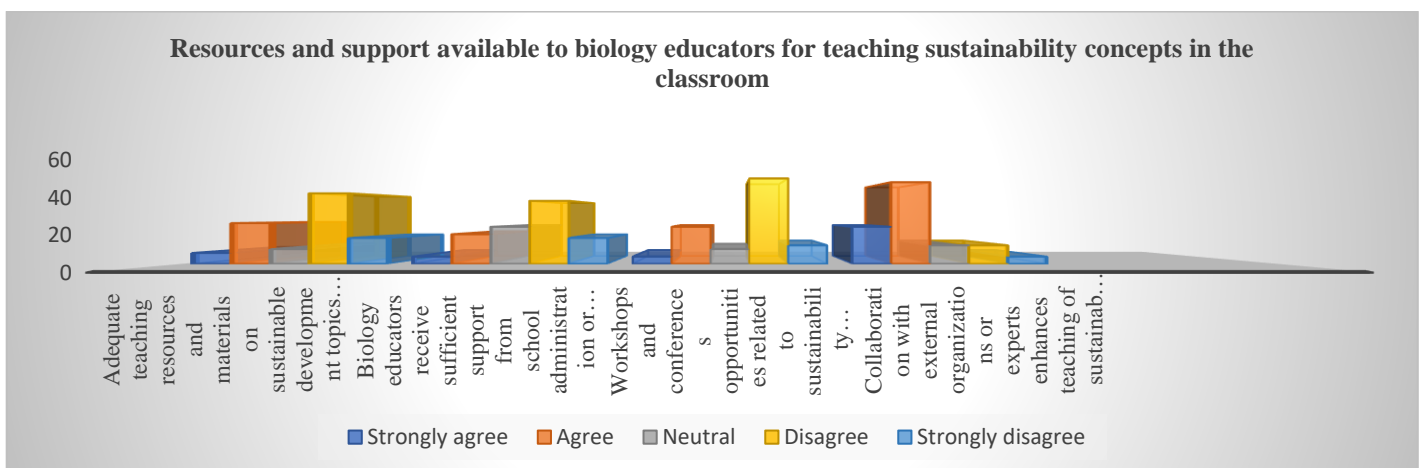


Figure 3: Resources and support available to biology educators for teaching sustainability concepts

Figure 3 provides insights into the resources and support available to biology educators for teaching sustainability concepts in the classroom. Firstly, the availability of adequate teaching resources and materials on sustainable development topics is perceived as relatively low, with only 6.8% of respondents strongly agreeing and 25.0% agreeing. This suggests a potential gap in the availability of comprehensive resources needed to effectively teach sustainability concepts, highlighting the need for enhanced resource provision. Furthermore, biology educators express varying levels of satisfaction regarding the support received from school administration or educational institutions to teach sustainability, with 4.5% strongly agreeing and 18.2% agreeing. This indicates a need for improved institutional support mechanisms to facilitate sustainability education efforts. Additionally, while opportunities for workshops and conferences related to sustainability education are perceived as relatively accessible, with 4.5% strongly agreeing and 22.7% agreeing, there is room for enhancement to ensure broader participation and engagement. Finally, collaboration with external organizations or experts emerges as a valuable support mechanism, with 22.7% of respondents strongly agreeing and 50.0% agreeing. This highlights the importance of fostering partnerships with external stakeholders to enrich sustainability education initiatives. These findings underscore the importance of enhancing resource provision, institutional support, and collaboration opportunities to empower biology educators in effectively teaching sustainability concepts in the classroom.

Research question four: What are the attitudes of biology educators towards teaching sustainable development concepts, and how do these attitudes impact their instructional strategies?

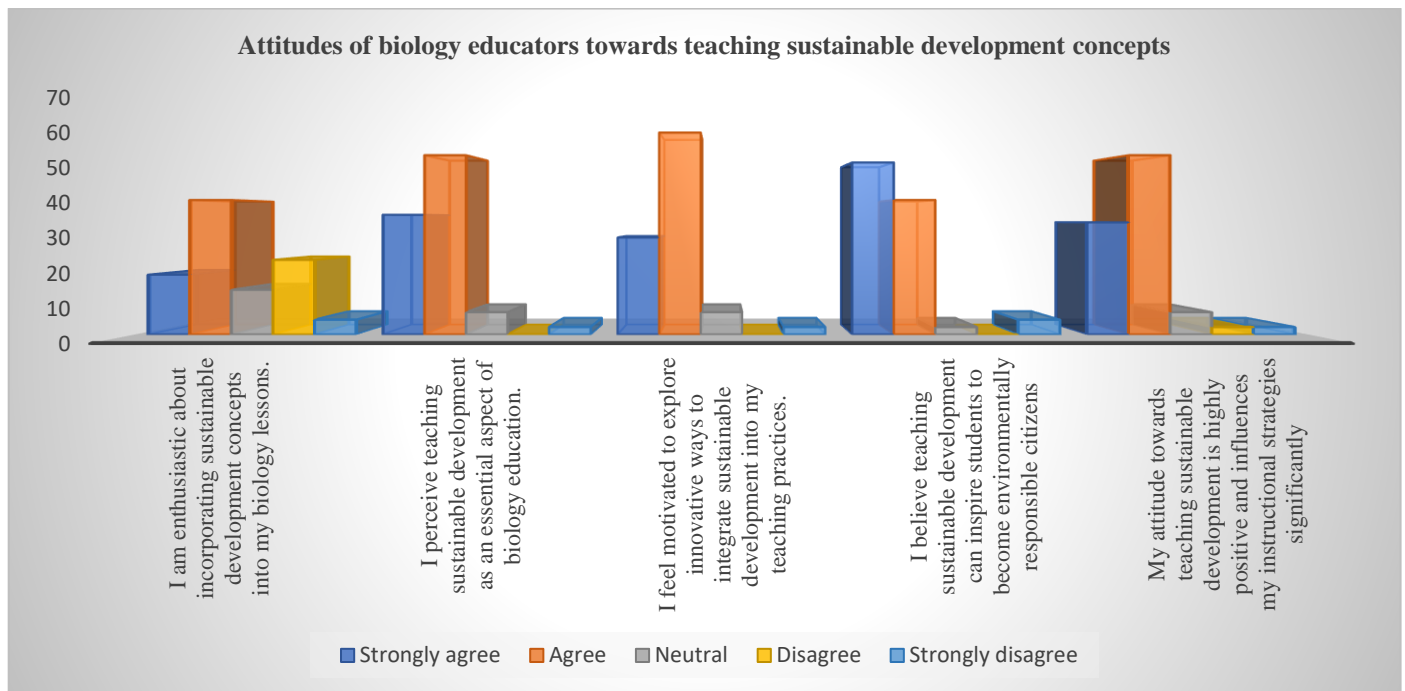


Figure 4: Attitudes of biology educators towards teaching sustainable development concepts

Figure 4 presents the attitudes of biology educators towards teaching sustainable development concepts and their impact on instructional strategies. Firstly, a significant proportion of educators express enthusiasm for incorporating sustainable development concepts into their biology lessons, with 18.2% strongly agreeing and 40.9% agreeing. This positive attitude underscores the potential for engaging and impactful sustainability education. Moreover, the majority of respondents perceive teaching sustainable development as an essential aspect of biology education, with 36.4% strongly agreeing and 54.5% agreeing. This highlights a widespread recognition of the importance of sustainability education in shaping environmentally responsible citizens. In addition, educators demonstrate motivation to explore innovative ways to integrate sustainable development into their teaching practices, with 29.5% strongly agreeing and 61.4% agreeing. This proactive stance towards innovation suggests a readiness to adapt instructional strategies to enhance sustainability education outcomes. Furthermore, educators believe that teaching sustainable development can inspire students to become environmentally responsible citizens, with 52.3% strongly agreeing and 40.9% agreeing. This positive outlook reflects a shared belief in the transformative potential of sustainability education. Finally, educators' highly

positive attitudes towards teaching sustainable development significantly influence their instructional strategies, as indicated by 34.1% strongly agreeing and 54.5% agreeing. This suggests that attitudes play a pivotal role in shaping instructional approaches and fostering a conducive learning environment for sustainability education. These findings highlight the crucial role of educators' attitudes in driving effective integration of sustainable development concepts into biology education and shaping instructional practices to inspire environmental stewardship among students.

DISCUSSION

The investigation probed into the integration of sustainable development concepts within biology education, revealing both promising trends and notable challenges. The study portrays a moderate engagement level among biology educators in incorporating sustainability into their teaching practices. According to Taylor *et al.*, (2015), a lack of consensus on defining sustainability may contribute to teachers' lack of vision regarding sustainability and how to integrate it into the curriculum. While diverse teaching methods are employed to highlight sustainability concepts, collaborative efforts with other educators receive substantial agreement, emphasizing the importance of teamwork in promoting sustainability education.

Furthermore, significant barriers hinder the effective integration of sustainable development. Time constraints, inadequate resources, and limited training opportunities pose notable challenges. Moreover, resistance from students and difficulty aligning with standardized testing requirements present additional hurdles. The study results are consistent with those of Kandangama (2018), who indicated that school teachers faced moderate to significant challenges when teaching sustainable development. Barriers identified include the exam-oriented mentality of students, lack of awareness of sustainable development concepts among teachers, absence of education for sustainable development programs in the school timetable, and time constraints. Insights into available resources highlight a potential gap in comprehensive materials and the need for enhanced institutional support. Collaboration with external stakeholders emerges as a valuable mechanism to enrich sustainability education initiatives.

Despite challenges, educators express enthusiasm for incorporating sustainable development concepts. This positive attitude underscores the potential for impactful sustainability education and emphasizes the crucial role of educators' attitudes in driving effective integration. There are similarities between the attitudes expressed by the teachers in this study and those described by Peedikayil *et al.* (2023), whose findings also showed that teachers have a favorable attitude towards sustainable development. This alignment in attitudes across studies highlights the consistent dedication among educators towards fostering sustainability education, which serves as a promising foundation for enhancing environmental literacy and promoting a culture of sustainability in educational settings.

CONCLUSION

This research sheds light on the practices, challenges, resources, and attitudes surrounding the integration of sustainable development into biology education. The findings reveal a moderate level of engagement among biology educators in incorporating sustainability concepts into their teaching practices, with an emphasis on diverse teaching methods and collaborative efforts. However, significant challenges such as time constraints, inadequate resources, and resistance from stakeholders hinder effective integration. Despite these obstacles, educators demonstrate enthusiasm for teaching sustainability and recognize its importance in shaping environmentally responsible citizens. The study underscores the crucial role of educators' attitudes in driving effective integration and highlights the need for enhanced resources, institutional support, and collaboration opportunities to empower biology educators in promoting sustainability education. By addressing these challenges and building on promising practices, educators can better prepare students to address environmental challenges and contribute to sustainable solutions in the 21st century.

RECOMMENDATIONS

Based on the findings and conclusions of this study, the following recommendations are proposed to enhance the integration of sustainable development concepts into biology education:

1. Organize targeted training programs, workshops, and conferences focused on sustainable development education to equip biology educators with the knowledge, skills, and confidence to integrate these concepts effectively.
2. Provide ongoing professional development initiatives to ensure educators remain updated on emerging sustainability topics and teaching strategies.
3. Develop and distribute comprehensive teaching resources, including lesson plans, multimedia tools, and case studies, specifically designed to support sustainable development education in biology.
4. Collaborate with educational publishers, government bodies, and NGOs to create a repository of accessible and high-quality materials.
5. Integrate sustainable development concepts into the existing biology curriculum to ensure they align with core teaching objectives and reduce the additional time burden on educators.
6. Allocate specific time slots within school timetables dedicated to sustainability education to prioritize its implementation.
7. Establish monitoring and evaluation systems to assess the progress of sustainability integration and provide constructive feedback to educators.
8. Promote collaborative efforts among biology educators to share best practices, teaching strategies, and resources for sustainability education.
9. Build partnerships with external organizations, such as environmental groups, universities, and industry experts, to provide additional support and enrich classroom learning experiences.

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