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The Role of the GLOBE Program in Transforming Teaching Methods Among Omani Teachers into A Green Education Approach

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Abstract:
Green education has become essential to modern teaching practices, promoting environmental awareness. The GLOBE program is an international initiative that engages teachers and students in practical environmental research and data collection. This study examines the role of the GLOBE program in transforming Omani teachers' teaching methods toward a green education approach while also highlighting the challenges they face in its implementation. A descriptive research approach was adopted, utilizing electronic questionnaires distributed to teachers participating in the GLOBE program. The study sample included 44 Omani teachers from various schools implementing the program. Two research instruments were employed: a questionnaire measuring teachers' transition to green education practices and another identifying the challenges they encounter in this process. The reliability of the instruments was assessed using Cronbach's alpha, which confirmed high internal consistency and validity. The results indicate that the GLOBE program significantly enhanced teachers' capabilities in planning and implementing green education, particularly in classroom activities and in raising students' environmental awareness. Moderate performance was observed in assessing student outcomes and implementing green practices outside the classroom, suggesting areas for improvement. Statistical analysis revealed significant differences in the adoption of green education between teachers who participated in the GLOBE program and those who did not, underscoring its positive impact. The study recommends targeted teacher training programs and additional resources to facilitate the integration of green education. Fostering collaboration among teachers and developing flexible schedules could help overcome time-related challenges. Establishing partnerships between schools and environmental organizations is also recommended to promote sustainability-focused teaching practices.

Keywords: Green Education, GLOBE Program, Sustainability in Teaching, Environmental Awareness, Teacher Pedagogical Transformation.

1. Introduction

In recent years, green education has gained significant attention as environmental sustainability has become a global priority. With climate change, resource depletion, and environmental degradation posing critical challenges worldwide, education plays a pivotal role in fostering environmental awareness, responsibility, and action among future generations. Green education, which integrates ecological

principles, sustainability concepts, and environmental ethics into teaching and learning, has emerged as a vital approach to preparing students to understand, analyze, and address these pressing challenges.

A core aspect of green education is its emphasis on interdisciplinary learning and experiential engagement. By incorporating real-world applications, scientific inquiry, and technological tools, green education encourages students to develop problem-solving skills, critical thinking abilities, and a sense of global citizenship. This approach not only enriches students' scientific knowledge but also equips them with the tools necessary to contribute to sustainable development efforts in their communities and beyond.

The increasing global emphasis on environmental sustainability has led to a growing recognition of the importance of green education in shaping environmentally conscious individuals. While numerous initiatives aim to integrate sustainability principles into educational systems, structured programs like the Global Learning and Observations to Benefit the Environment (GLOBE) Program play a unique role in bridging scientific inquiry with hands-on learning. The program encourages students and educators to engage in data-driven environmental monitoring, fostering a culture of sustainability-focused pedagogy.

In Oman, the GLOBE Program has been actively implemented since 2009, engaging schools in scientific collaboration and environmental research. However, despite the program's promising objectives, there is limited research on its direct impact on teachers' instructional methods and the extent to which it transforms conventional teaching into a green education approach. Moreover, various contextual challenges may hinder the effective implementation of the GLOBE Program in Omani schools, potentially affecting its long-term sustainability and effectiveness.

Several studies have explored the importance of environmental education and sustainable development in curricula (Al-Hadeede & Ambusaidi, 2020; Al-Husseini, 2020; Hudson, 2001; Leung & Ng, 2019). However, a notable gap exists in the literature regarding how structured programs like the GLOBE Program influence teachers' pedagogical transformations. While research highlights theoretical frameworks and the general benefits of environmental education, empirical evidence remains limited in the following areas: How the GLOBE Program specifically shapes teaching methodologies and fosters a shift toward sustainability-driven instruction in Oman. The challenges and barriers educators face in integrating green education principles into classroom practices. The role of digital tools, hands-on scientific learning, and interdisciplinary approaches in overcoming these challenges.

This study is significant for both academic discourse and the practical application of green education in Oman. By analyzing the GLOBE Program's role in fostering sustainability-focused teaching, this research will assist policymakers, educators, and institutions in developing more effective environmental education strategies. Additionally, identifying the barriers to implementing green education will enable stakeholders to devise targeted interventions, ensuring that sustainable teaching practices are both feasible and impactful. Therefore, this study serves as a critical step in bridging the gap between green education theory and its practical application in Omani schools.

This study holds significance for both academic discourse and the practical application of green education in Oman. By examining the GLOBE Program's role in fostering sustainability-focused teaching, this research provides valuable insights for policymakers, educators, and institutions aiming to enhance environmental education within the national curriculum.

From an academic perspective, this study contributes to the existing body of knowledge on environmental education by addressing a critical research gap—how structured programs like the GLOBE Program influence teaching methodologies, pedagogical transformations, and student engagement. While previous research highlights the importance of integrating sustainability into curricula, empirical evidence on its

real-world application, effectiveness, and challenges in Oman remains limited. This study helps bridge this gap by offering context-specific findings and recommendations that inform future research and policy development.

From a practical standpoint, the study provides actionable insights to improve green education practices in Omani schools. By identifying barriers to effective implementation, this research enables educational stakeholders to develop targeted interventions that support teachers in integrating environmental sustainability into their instructional methods.

2. Research Problem:

The integration of green education across primary, secondary, and higher education levels plays a vital role in cultivating environmental awareness and fostering sustainable practices among students. By introducing environmental education at an early stage, learners develop the necessary knowledge, skills, values, and attitudes to recognize, analyze, and address pressing environmental challenges. This proactive approach empowers individuals to make informed decisions and take meaningful actions that contribute to long-term sustainability.

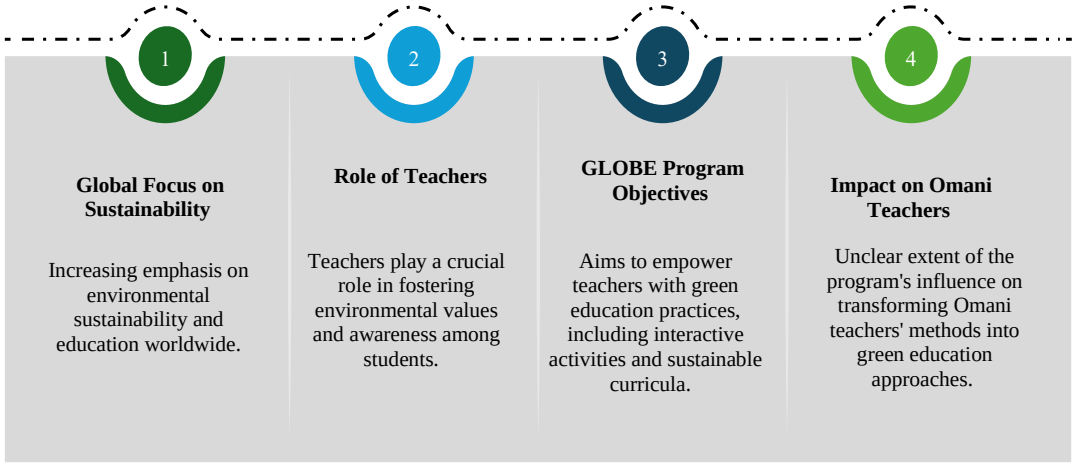
Beyond raising awareness, green education equips students with a comprehensive understanding of environmental issues, including their root causes, far-reaching consequences, and complex interconnections with social, economic, and ecological systems. As students' progress through different educational levels, their exposure to sustainability concepts deepens, enabling them to critically engage with real-world environmental problems and develop innovative solutions. By embedding environmental literacy into the curriculum, educational institutions can nurture a generation of responsible citizens committed to preserving natural resources and mitigating environmental degradation. This holistic approach to education ensures that sustainability becomes a fundamental aspect of lifelong learning and societal development (Adnyana & Sudaryati, 2023).

Blazar and Kraft's (2017) study, Teacher and Teaching Effects on Students' Attitudes and Behaviors, highlights the profound impact of teachers on students' self-efficacy, attitudes, and behaviors. Their research found that variations in teaching practices—such as providing emotional support and maintaining effective classroom organization—are strongly linked to positive student outcomes. Teachers who create an engaging and supportive learning environment contribute not only to academic achievement but also to students' overall motivation, happiness, and classroom behavior. This underscores the critical role of educators in shaping students' cognitive and behavioral development.

Milanović, Demajo, and Gojkov-Rajić (2019) emphasize that the GLOBE Program enhances teachers' instructional methods by integrating hands-on, inquiry-based learning, which fosters active student engagement with environmental science. The program encourages teachers to incorporate real-world data collection, collaborative projects, and outdoor learning experiences, reinforcing sustainability principles within the curriculum. This experiential approach not only strengthens students' environmental awareness but also equips educators with effective strategies for implementing green education practices.

Based on these insights, this study identifies four main justifications for the research problem, as illustrated in the figure below:

Figure 1: The Main Justifications for The Research



Therefore, the research problem lies in answering the following question: “What is the role of the GLOBE Program in transforming teaching methods among Omani teachers into a green education approach, and what are the obstacles to applying this approach? "

Research Objectives

This study seeks to achieve the following key objectives:

1. **Assessing the Impact of the GLOBE Program:**
   - Evaluate how participation in the GLOBE Program influences the transformation of traditional teaching methods into green education approaches.
   - Analyze the extent to which the program enhances teachers' ability to integrate environmental sustainability into their instructional strategies.
2. **Identifying Challenges in Implementing Green Teaching Methods:**
   - Investigate the specific challenges faced by Omani teachers when applying green teaching methodologies within the framework of the GLOBE Program.
   - Examine factors such as resource limitations, training gaps, administrative support, and time constraints that may impact the effective implementation of sustainable education practices.

By addressing these objectives, the study aims to provide insights and recommendations to enhance the effectiveness of green education initiatives and support teachers in overcoming obstacles to sustainability-focused teaching.

3. **Research Importance:**

This study holds significance in multiple aspects:

- It provides empirical evidence on the real-world application of green education in Oman.
- It informs future research and policy development related to sustainability in education.
- It identifies the challenges Omani teachers face in implementing green education.
- It enhances resource allocation strategies to integrate green education effectively.
- It promotes environmental awareness, responsibility, and action among students.
- It aligns with Oman’s national vision for sustainable development and global ecological conservation efforts.
- It encourages partnerships between schools and environmental organizations to facilitate hands-on learning experiences.

- It contributes to the enhancement of environmental education policies in Oman.
- It supports the integration of green education into the national curriculum for long-term sustainability.

4. Research Questions:

To address these objectives, the study explores the following questions:

1. How does the GLOBE Program influence Omani teachers' educational practices in the context of green education?
2. Are there statistically significant differences in adopting green education practices between teachers who participate in the program and those who do not?
3. What challenges do Omani teachers encounter when implementing green teaching methods through the GLOBE Program?

5. Delimitations of Research

This study explores the role of the GLOBE Program in transforming teaching methods in Omani schools by promoting a green education approach during the 2024/2025 academic year. It examines how the program influences instructional strategies, fosters environmental awareness, and enhances sustainability-focused learning experiences. Additionally, the research identifies and analyzes the challenges teachers encounter when utilizing GLOBE tools to implement green teaching methods effectively.

The study employs a descriptive research approach, focusing on teachers' experiences, perceptions, and obstacles in adopting GLOBE-based methodologies. Data is collected through electronic questionnaires distributed via Google Forms, ensuring accessibility and ease of participation for educators from various schools across Oman. The research does not include direct classroom observations, student feedback, or comparative studies with non-GLOBE schools, as it primarily aims to assess teachers' perspectives on the program's implementation and challenges.

6. Literature review and previous studies:

The GLOBE Program

The Global Learning and Observations to Benefit the Environment (GLOBE) Program is an international initiative led by NASA in collaboration with multiple organizations, including the National Oceanic and Atmospheric Administration (NOAA) and the National Science Foundation (NSF). Established in 1994, the program aims to enhance scientific understanding of the environment by engaging students, teachers, and citizen scientists in collaborative research efforts. Through hands-on data collection, participants contribute valuable information to a global database, which scientists use to monitor and analyze environmental changes.

GLOBE participants gather atmospheric, hydrologic, geologic, and biometric data from local study sites, allowing them to observe real-time environmental patterns and trends. These observations contribute to climate change studies, weather pattern analysis, and biodiversity assessments. The data, once collected, is shared through the GLOBE network, where students can compare their findings with those of peers from different regions worldwide. Scientists then incorporate this crowdsourced information into broader research projects, fostering a sense of global collaboration in environmental science (Kennedy & Henderson, 2019).

According to the GLOBE Program Team (personal communication, January 5, 2025), Oman officially joined the GLOBE Program on December 8, 2009. Since then, GLOBE Oman has played a vital role in

promoting environmental awareness and scientific engagement among students. The initiative has encouraged schools across the country to integrate field-based research and hands-on learning experiences into their curricula. As of 2025, 44 schools in Oman are actively participating in the program, with 44 teachers trained to guide students in environmental data collection and analysis. These educators facilitate student-led research projects, fostering critical thinking and problem-solving skills while instilling a sense of environmental stewardship.

The GLOBE Program also leverages digital tools and technology to enhance data collection and educational experiences. Participants use mobile applications, online databases, and digital sensors to record and submit their observations efficiently. This technological integration has made the program an effective approach to overcoming traditional challenges in implementing environmental education, such as limited access to field resources and the need for real-time data sharing.

Al-Husseini (2020), in Green Education: A Future-Oriented Approach in the Digital Era, explores the integration of environmental education with digital advancements. The study highlights strategies for merging technology with ecological studies, emphasizing how digital tools, such as interactive simulations, virtual field trips, and artificial intelligence-driven climate models, can enhance student engagement and understanding. Al-Husseini underscores the necessity of adapting educational systems to the digital era, ensuring that students develop both scientific literacy and a strong commitment to sustainability.

By merging scientific inquiry, global collaboration, and digital innovation, the GLOBE Program empowers students and educators to become active contributors to environmental research. As environmental challenges continue to grow, initiatives like GLOBE play a critical role in fostering a generation of informed and environmentally conscious individuals.

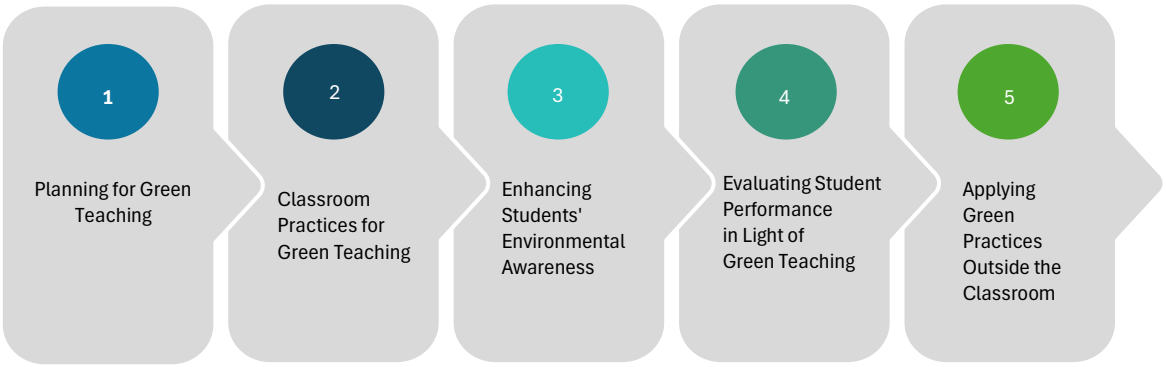
Green Education:

Green education has garnered significant attention in recent years as educators and policymakers recognize its role in fostering environmental awareness, promoting sustainable practices, and enhancing overall educational outcomes. Numerous studies have explored the impact of green education on students, examining how environmentally focused curricula influence their knowledge, attitudes, and behaviors toward sustainability. This section provides a comprehensive review of relevant research on green education initiatives, highlighting various teaching methodologies, their effectiveness, and the challenges associated with their implementation in different educational contexts. By analyzing previous studies, this review aims to establish a foundation for understanding the transformative potential of green education in shaping future generations' sense of environmental responsibility.

Leung and Ng (2019) define green education as an approach that promotes environmental, social, and economic sustainability. Effective green teaching integrates pedagogical principles, learning theories, and practical strategies to enhance student engagement and learning outcomes. Drawing on McCarthy (1987) and Bloom’s Taxonomy (1956), a well-structured green education model should include the following key elements: Clear Learning Objectives – Goals should align with Bloom’s cognitive levels, ensuring progressive skill development. Active Learning Strategies – Problem-based learning, hands-on projects, and experiential activities enhance engagement. Differentiated Instruction – Personalized learning experiences support diverse learning styles. Assessment and Feedback – A combination of formative (e.g., quizzes, peer reviews) and summative (e.g., final projects, exams) assessments helps track progress. Technology Integration – Digital tools and real-world applications improve relevance and student involvement. Real-World Connections – Engaging students in sustainability-related challenges,

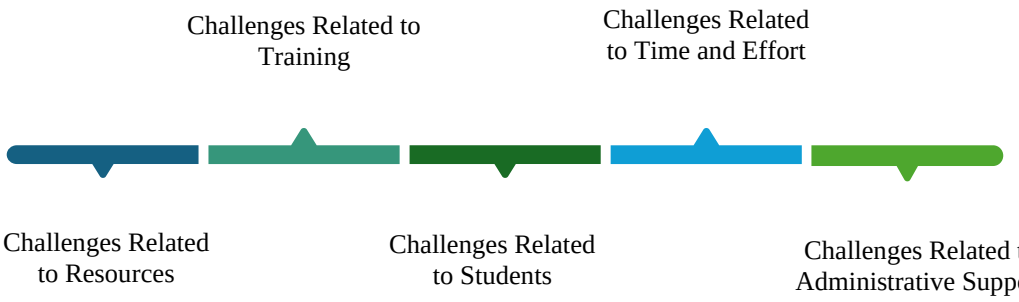
collaborations, and industry trends fosters deeper learning. Classroom Management – Motivational strategies, such as gamification and collaborative activities, create an inclusive learning environment.
Building on these principles, this study defines the green teaching approach as an educational strategy that integrates environmental sustainability and conservation into the teaching and learning process. The key domains of this approach are illustrated in the figure below.

Figure 2: Green Education Approach Domains



The effectiveness of environmental education (EE) is often hindered by several barriers (Hudson, 2001). One major challenge is the lack of resources and trained educators, particularly in developing countries with limited educational funding (Kunche et al., 2024). Schools in underprivileged areas often lack the financial support and materials necessary to integrate EE into their curricula. Additionally, political instability and weak policy frameworks further limit its prioritization in national education policies (Kunche et al., 2024).
Another significant obstacle is the limited time available within the school day, making it difficult for educators to incorporate EE into an already crowded curriculum (Ham & Sewing, 1988). Even when teachers recognize the importance of green education, inadequate training and limited access to resources make it challenging to implement effectively. Al-Hadeede and Ambusaidi (2020) highlight that teacher in Oman struggle to apply environmental education programs due to these barriers. Without proper training and curriculum support, many educators struggle to integrate sustainability concepts into their lessons.
Hotchkiss (2016) examined elementary teachers' attitudes and self-efficacy in teaching EE. A survey of 201 U.S. public school teachers (K-5) assessed their advocacy for EE, confidence in their knowledge, and access to training. The study found that while teachers held positive attitudes toward EE and believed it could be integrated into core subjects, they hesitated to address controversial topics. Despite recognizing the importance of outdoor learning, they did not strongly advocate for it, citing limited support. Many also reported minimal training and little administrative backing for EE implementation.
Based on these findings, the challenges teachers face when using GLOBE tools for green education can be categorized into the following groups, as shown in Figure 2: Resource Constraints – Lack of funding, teaching materials, and digital tools. Time Limitations – Difficulty integrating EE into an overloaded curriculum. Teacher Training Gaps – Insufficient professional development and support. Policy & Administrative Barriers – Weak national policies and limited school-level backing.

figure 3: challenges categories



8. Methodology:

This study adopts a descriptive research approach to analyze the extent to which teachers in the GLOBE Program implement green education practices. The study also examines the challenges they encounter while transitioning to a green teaching methodology.

Research Sample:

According to the GLOBE Program Team (personal communication, January 5, 2025), the GLOBE program has been implemented in 44 schools across various districts of Dhofar during the 2024/2025 academic year. Based on this implementation, the research sample was structured as follows:

Table 1: Research Sample

Category	Number
Teachers supervising the GLOBE program in GLOBE schools	44
Teachers not participating in the program	44
Total	88

This balanced sample composition allows for a comparative analysis of the impact of the GLOBE program by evaluating differences between participating and non-participating teachers. This approach ensures a comprehensive understanding of the program's effectiveness in facilitating the transition to green education practices.

Research Tools:

First Tool: Questionnaire for Measuring Teachers' Transition to Green Teaching Methods in the GLOBE Program

Based on the theoretical framework established in previous research, this questionnaire has been developed to assess the extent to which teachers in the GLOBE Program implement components of green teaching methodologies. The questionnaire is designed to evaluate various aspects of green education, including sustainable teaching practices, environmental awareness, and the integration of eco-friendly strategies into classroom instruction.

The questionnaire measures key indicators of green teaching, ensuring a comprehensive analysis of how effectively teachers transition to environmentally focused methodologies. The following sections outline the specific components assessed in the questionnaire:

First: Planning for Green Education

1. I integrate environmental and sustainability topics into my lessons.
2. I set educational goals aimed at enhancing students' environmental awareness.
3. I use real-life examples related to environmental protection to illustrate academic concepts.
4. I plan classroom activities that support eco-friendly practices.
5. I use renewable and environmentally friendly educational resources.

Second: Green Education Practices in the Classroom

1. I encourage students to think of environmental solutions for societal problems.
2. I use teamwork-based learning strategies to solve environmental issues.
3. I guide students to reduce resource consumption (such as paper and energy) during classroom activities.
4. I allocate time to discuss the impact of human behavior on the environment.
5. I use technology to reduce the use of unsustainable resources (such as paper).

Third: Enhancing Students' Environmental Awareness

1. I encourage students to participate in environmental activities inside and outside the school.
2. I motivate students to create projects or ideas that support environmental sustainability.
3. I guide students to explore environmental challenges in their communities.
4. I ask students to propose suggestions for improving the school environment.
5. I work on developing students' sense of environmental responsibility.

Fourth: Assessment and Practices Related to Green Education

1. I assess students' awareness of environmental issues within classroom evaluations.
2. I incorporate environmental standards into the assessment of classroom projects.
3. I ask students to prepare reports or presentations on environmental topics.
4. I use feedback to encourage students to improve their environmental awareness and behavior.
5. I monitor the impact of green education activities on students' performance and behavior.

Fifth: Implementing Green Education Outside the Classroom

1. I participate in community environmental activities to enhance my green education experience.
2. I collaborate with my colleagues to develop joint environmental programs in the school.
3. I encourage students to promote sustainability ideas in their homes.
4. I participate in training sessions or workshops on green education.
5. I seek partnerships with organizations or entities that support the environment to improve education.

Reliability and Validity of the Questionnaire

To measure the reliability and validity of the tool, it was applied to a survey sample of 40 teachers. The following table illustrates the distribution of the questionnaire's domains, their respective items, and the internal consistency validity coefficients, where respondents determine the extent to which items are met by giving each item a rating on a five-point Likert scale:

Table 2: Description of the first questionnaire

Questionnaire Domains	Number of Items	Internal Consistency Coefficient
Planning for Green Teaching	5	0.91

Classroom Practices for Green Teaching	5	0.87
Enhancing Students' Environmental Awareness	5	0.96
Evaluating Student Performance in Light of Green Teaching	5	0.92
Applying Green Practices Outside the Classroom	5	0.82

The validity coefficients in the table above indicate high levels of internal consistency. Regarding the reliability of the questionnaire, the overall reliability coefficient (Cronbach's Alpha) was calculated and found to be 0.96, indicating an excellent level of reliability. This result demonstrates that the questionnaire has high internal consistency and reliability, making it a dependable tool for measuring its intended purpose.

Second Tool: Challenges of Transitioning to Green Education in the Implementation of the GLOBE Program.

By benefiting from what was reached through the theoretical review of literary frameworks and previous studies, which identified the main groups that constitute the challenges that teachers may face when applying the GLOBE program as a tool for green education, the items of the second questionnaire were designed as follows, where respondents rate each challenge item on a five-point Likert scale to indicate to what extent the item faced them:

1. **Challenges Related to Resources**
- I face a lack of environmental educational resources (such as tools and materials).
- The school lacks a sufficient budget to support environmental activities.
- I find it difficult to access updated and renewable educational materials.
- The school's infrastructure is not equipped to support green education (such as green spaces).

2. **Challenges Related to Training**
- I need more training to understand how to integrate green education into the curriculum.
- The training I received in the GLOBE program is insufficient for effectively implementing green education.
- I struggle to keep up with new developments related to green education.

3. **Challenges Related to Students**
- I find it difficult to capture students' attention on green education topics.
- Students lack motivation to participate in environmental activities.
- I face challenges in simplifying environmental and sustainability concepts to suit students' ages.

4. **Challenges Related to Time and Effort**
- The limited time allocated for classes makes it difficult to implement green education.
- I need extra time to prepare environmental educational activities.
- Implementing green education requires more effort compared to traditional methods.

5. **Challenges Related to Administrative Support**
- I do not receive sufficient support from the school administration to implement green education.
- There is a lack of encouragement to carry out environmental education activities.
- Administrative procedures hinder the effective implementation of environmental activities.

The tool was used on a survey sample of 40 teachers in order to assess its validity and reliability. The table below illustrates the distribution of the items and the internal consistency validity coefficients for each domain:

Table 3: Description of the second questionnaire

Category	Number of Items	Internal Consistency Coefficient
Challenges Related to Resources	4	0.934
Challenges Related to Training	3	0.995
Challenges Related to Students	3	0.955
Challenges Related to Time and Effort	3	0.999
Challenges Related to Administrative Support	3	0.928

The values presented in the table demonstrate that all domains within the questionnaire exhibit a high degree of internal consistency, signifying that the instrument is effective in accurately measuring the intended aspects of green education. This strong internal consistency enhances the overall validity of the questionnaire, ensuring that each domain reliably assesses the targeted concepts.

Furthermore, to evaluate the reliability of the questionnaire, Cronbach's Alpha coefficient was calculated, yielding a value of 0.83. This result indicates a good level of internal reliability, confirming that the questionnaire items are highly interrelated and consistently measure the underlying constructs. In other words, respondents provided responses that aligned well across different items within the same domain, reinforcing the dependability and coherence of the questionnaire as a tool for assessing the challenges and effectiveness of green education implementation.

9. Research Results

Firstly: The Extent of the Transition of GLOBE Program Teachers to the Green Education Approach:

Table 4: The Extent of Transition of GLOBE Program Teachers to the Green Education Approach

Category	Average Score	Intensity Level
Planning for Green Education	4.268182	High
Classroom Practices for Green Education	4.204545	High
Raising Environmental Awareness among Students	4.290909	High
Evaluating Student Performances	3.8	Moderate

Applying Green Practices Outside the Classroom	3.786364	Moderate

The GLOBE program has played a pivotal role in enhancing teachers' capabilities in both planning and implementing green education practices. Teachers demonstrated particularly strong performance in classroom-based activities and raising students' environmental awareness, suggesting that the program effectively equips educators with the skills and knowledge needed to integrate sustainability concepts into daily instruction.

However, the findings also highlight moderate performance in evaluating student outcomes and applying green education beyond the classroom, indicating areas in need of further development and targeted support. These aspects may require additional training, resources, or structured frameworks to ensure a more comprehensive and sustained impact on students' learning experiences.

These results align with the study by Al-Husseini (2020), which emphasized that structured environmental programs—when paired with adequate educational tools and project-based learning approaches—can significantly support teachers in adopting green teaching methodologies. This reinforces the importance of institutional support and continuous professional development to maximize the effectiveness of green education initiatives.

Secondly: Analysis of Statistical Differences Among Teachers in the Extent of Transition to the Green Education Approach Based on the Participation Variable in the GLOBE Program:

Table 5: Differences Among Teachers in the Extent of Transition to the Green Education Approach

Category	t-statistic	P-value	Significant Difference
Planning for Green Education	4.83501	8.17E-06	TRUE
Classroom Practices for Green Education	3.760683	0.000335	TRUE
Raising Environmental Awareness among Students	3.669884	0.000425	TRUE
Evaluating Student Performances	2.015463	0.047013	TRUE
Applying Green Practices Outside the Classroom	2.786746	0.006556	TRUE

The statistical analysis revealed significant differences across all measured dimensions between teachers who participated in the GLOBE program and those who did not. These findings indicate that participation in the program had a substantial impact on teachers' ability to adopt and implement green education concepts effectively.

The differences suggest that teachers involved in the GLOBE program demonstrated higher levels of integration of sustainability principles into their teaching practices, curriculum planning, and student engagement strategies compared to their non-participating counterparts. This result underscores the program's effectiveness in enhancing educators' competencies in green education, reinforcing its role as a valuable tool for promoting environmental awareness and sustainable teaching methodologies.

Thirdly: The challenges of Transitioning to Green Education in the Implementation of the GLOBE Program:

Table 6: Challenges of Transitioning to Green Education in the Implementation of the GLOBE Program

Category	Average Severity Score	Severity Description
Challenges Related Resources	4.83501	Medium
Challenges Related Training	3.760683	Medium
Challenges Related to Student	3.669884	Medium
Challenges Related to Time and Effort	2.015463	Medium
Challenges Related to Administrative Support	2.786746	Medium

The challenges associated with time and effort emerged as the most significant among all categories, with an average severity score of 3.92. This finding suggests that teachers encounter considerable difficulties in allocating the necessary time and energy to effectively implement green education practices. The demanding nature of integrating sustainability-focused activities into lesson plans, managing classroom dynamics, and ensuring meaningful student engagement may contribute to this challenge.

Moreover, these findings are consistent with the study by Al-Hadeede and Ambusaidi (2020), which also highlighted the substantial workload and time constraints faced by educators when incorporating green education methodologies. This reinforces the need for strategic interventions, such as optimized scheduling, resource support, and professional development programs, to ease the burden on teachers and facilitate a smoother transition toward sustainable teaching practices.

9. Conclusions

Strong Performance in Key Areas – Teachers participating in the GLOBE Program demonstrated high proficiency in classroom practices, green education planning, and fostering environmental awareness among students. These strong results indicate a high level of expertise and alignment with green education objectives.

Moderate Achievement in Evaluation and Practical Application – The findings suggest that while teachers effectively integrate green education within the classroom, there is room for improvement in applying green practices beyond the classroom and in evaluating student performance in sustainability-focused learning.

Overall Positive Impact of the GLOBE Program – The consistently high and moderate scores across various categories indicate that the GLOBE Program significantly contributes to promoting green education among participating teachers.

Time and Effort Present the Greatest Challenge – Among all assessed factors, time and effort constraints were rated as the most significant challenge (average score: 3.92), highlighting the difficulty teachers face in managing the workload required to implement green education effectively.

Administrative Support Remains a Moderate Challenge – With an average score of 2.72, administrative support was identified as an area requiring further improvement. This suggests that while some support exists, teachers need stronger institutional backing to enhance green education efforts.

Varied Individual Challenges – Teachers face diverse challenges, with some areas, such as resource availability and training, scoring higher in difficulty than others. This variation underscores the need for targeted solutions to address specific obstacles faced by educators.

10. Recommendations:

1. Develop targeted training programs to equip teachers with the skills to assess student achievement effectively based on green education principles.
2. Encourage hands-on environmental projects that integrate real-world activities and community engagement, extending green practices beyond the classroom.
3. Implement regular evaluation and feedback mechanisms to monitor teachers' progress and identify areas for continuous improvement.
4. Provide ongoing professional development opportunities tailored to individual teachers' needs, ensuring sustained growth in green education methodologies.
5. Expand the GLOBE Program's reach by increasing participation across schools and regions, amplifying its impact on environmental education.
6. Establish collaborative educator networks to facilitate the exchange of best practices, success stories, and innovative teaching strategies.
7. Integrate task management and planning tools to streamline teachers' workloads and enhance efficiency in implementing green education initiatives.
8. Adopt flexible scheduling options to ensure teachers have sufficient time for planning, execution, and reflection on green education activities.
9. Strengthen communication channels between educators and administrators to foster a shared vision and institutional commitment to green education.
10. Enhance administrative support and resource allocation to help educators overcome logistical and organizational challenges in implementing sustainability-focused teaching.

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