

PERSPECTIVAS DOS PROFESSORES SOBRE A EDUCAÇÃO EM GESTÃO DE RESÍDUOS NOS PROGRAMAS DE FORMAÇÃO DE PROFESSORES NIGERIANOS PARA A SUSTENTABILIDADE

TEACHERS' PERSPECTIVES ON WASTE MANAGEMENT EDUCATION IN NIGERIAN TEACHER TRAINING PROGRAMMES FOR SUSTAINABILITY

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RESUMO

Introdução: A sustentabilidade ambiental é uma preocupação global crítica, com a gestão de resíduos desempenhando um papel fundamental na mitigação de riscos ecológicos e de saúde pública. A Nigéria gera mais de 32 milhões de toneladas de resíduos sólidos anualmente, com mais de 70% mal gerenciados, levando a graves consequências para a saúde e o meio ambiente. Os programas de formação de professores são cruciais para promover a consciência ambiental, porém a educação sobre gestão de resíduos é inadequadamente integrada aos currículos de formação docente. **Objetivos:** Este estudo explora as perspectivas de formadores de professores em pré-serviço sobre a incorporação da educação em gestão de resíduos nos programas de formação de professores na Nigéria para promover a sustentabilidade. **Métodos:** Uma abordagem qualitativa foi empregada para examinar as perspectivas dos formadores de professores em pré-serviço no Noroeste da Nigéria. Uma técnica de amostragem em múltiplos estágios foi utilizada para selecionar três Faculdades Federais de Educação, com 45 professores em pré-serviço selecionados aleatoriamente. Os dados foram coletados por meio de um questionário elaborado pelo pesquisador e analisados tematicamente usando o ATLAS.ti. Considerações éticas, incluindo consentimento informado e anonimato, foram rigorosamente mantidas. **Resultados:** Os resultados revelam uma consciência moderada sobre gestão de resíduos entre os professores em pré-serviço, com muitos compreendendo conceitos básicos, mas carecendo de conhecimentos mais profundos sobre sustentabilidade. A maioria dos participantes apoia fortemente a integração da gestão de resíduos nos currículos de formação de professores, mas expressa preocupações sobre a sobrecarga curricular e o limitado apoio institucional. Recursos insuficientes e treinamento inadequado foram identificados como as principais barreiras, com muitos professores dependendo de materiais desatualizados. **Discussão:** O estudo ressalta a necessidade de treinamento estruturado e recursos atualizados para apoiar os professores na oferta de educação sobre gestão de resíduos. Com base nas melhores práticas globais, a integração eficaz da educação para a sustentabilidade requer um equilíbrio entre conhecimento teórico e atividades práticas. A colaboração entre instituições educacionais e organizações ambientais pode melhorar a disponibilidade de recursos e a eficácia do ensino. **Conclusão:** Para enfrentar os desafios de gestão de resíduos da Nigéria, os programas de formação de professores devem incorporar a educação para a sustentabilidade. Investir no desenvolvimento profissional, atualizar recursos instrucionais e fomentar parcerias equipará os educadores para promover a gestão ambiental responsável entre as futuras gerações.

Palavras-chave: *Gestão de Resíduos, Formação de Professores, Sustentabilidade Ambiental, Integração Curricular e Conhecimento.*

ABSTRACT

Introduction: Environmental sustainability is a critical global concern, with waste management playing a key role in mitigating ecological and public health risks. Nigeria generates over 32 million tons of solid waste annually, with more than 70% mismanaged, leading to severe health and environmental consequences. Teacher training programs are crucial in fostering environmental awareness, yet waste management education is inadequately integrated into teacher education curricula. **Aims:** This study explores pre-service teacher educators' perspectives on incorporating waste management education into teacher training programs in Nigeria to promote sustainability. **Methods:** A qualitative approach was employed to examine the perspectives of pre-service teacher educators in North-Western Nigeria. A multi-stage sampling technique was used to select three Federal Colleges of Education,

with 45 pre-service teachers randomly sampled. Data were collected through a researcher-designed questionnaire and analyzed thematically using ATLAS.ti. Ethical considerations, including informed consent and anonymity, were strictly maintained. **Results:** Findings reveal moderate awareness of waste management among pre-service teachers, with many understanding basic concepts but lacking deeper sustainability knowledge. Most participants strongly support integrating waste management into teacher education curricula but express concerns about curriculum overload and limited institutional support. Insufficient resources and training were identified as major barriers, with many teachers relying on outdated materials. **Discussion:** The study underscores the need for structured training and updated resources to support teachers in delivering waste management education. Drawing from global best practices, integrating sustainability education effectively requires balancing theoretical knowledge with practical activities. Collaboration between educational institutions and environmental organizations can enhance resource availability and teaching effectiveness. **Conclusion:** To address Nigeria's waste management challenges, teacher training programs must incorporate sustainability education. Investing in professional development, updating instructional resources, and fostering partnerships will equip educators to promote environmental stewardship among future generations.

Keywords: *Waste Management, Teacher Education, Environmental Sustainability, Curriculum Integration and Knowledge*

1. INTRODUCTION

Environmental sustainability has become an increasingly important global issue, with waste management being a critical component of this challenge. Nigeria, as Africa's most populous nation, faces significant waste management problems, which have severe implications for public health, environmental quality, and overall development. Despite generating over 32 million tons of solid waste annually, more than 70% of this waste is improperly managed, leading to widespread environmental degradation and health risks (World Bank, 2018). In this context, the education system, particularly teacher training programs, plays a crucial role in shaping the environmental consciousness of future generations. This study aims to explore teachers' perspectives on integrating waste management education into teacher training programs to promote environmental sustainability in Nigeria.

The current state of waste management in Nigeria is alarming. According to the United Nations Environment Programme (UNEP, 2020), only a small fraction of the waste generated in Nigerian cities is collected and properly disposed of, with most waste ending up in open dumpsites, rivers, or burned in the open air. These practices contribute to the contamination of water bodies, air pollution, and the spread of diseases such as cholera, dysentery, and respiratory illnesses (National Environmental Standards and Regulations Enforcement Agency [NESREA], 2021). Onyekwelu et al. (2022) reported that poor waste management is a significant factor in the spread of communicable diseases in Nigeria, with waste-related diseases contributing to high mortality rates, especially among children under five years old.

Given these challenges, there is an urgent need to enhance waste management practices across the country. Education, particularly at the formative stages of a child's development, is a powerful tool for instilling environmental awareness and promoting sustainable practices. However, the Nigerian education system, especially in teacher training programs, currently lacks a strong focus on environmental education, including waste management. This gap in the curriculum has significant implications for the ability of teachers to effectively educate students on the importance of environmental stewardship and sustainable practices. The role of teachers in promoting environmental sustainability cannot be overstated. Teachers are not only responsible for imparting knowledge but also for shaping the values, attitudes, and behaviors of their students. Studies have shown that when teachers are equipped with the necessary knowledge and skills, they can effectively influence their students' understanding and engagement with environmental issues (Kumar & Kumar, 2020). In this regard, integrating waste management education into teacher training programs is essential for fostering a culture of sustainability among future generations.

Despite the recognized importance of environmental education, there is a paucity of research on the perspectives of teachers regarding the integration of waste management content into teacher training programs in Nigeria. This study seeks to address this gap by exploring the attitudes, beliefs, and experiences of teachers concerning waste management education. By understanding teachers' perspectives, the study aims to identify the challenges and opportunities associated with integrating waste management into the teacher education curriculum and to

provide recommendations for enhancing the effectiveness of environmental education in Nigeria.

The importance of integrating waste management education into teacher training programs is supported by evidence from other countries. For instance, Finland, widely recognized for its high-quality education system, has successfully integrated environmental education, including waste management, into its teacher training programs. Finnish teachers are trained to incorporate sustainability into all aspects of their teaching, resulting in high levels of environmental awareness and engagement among students (Wolff et al., 2022). Similarly, South Korea has implemented a nationwide program that mandates the inclusion of environmental education in teacher training, leading to significant improvements in waste management practices and environmental consciousness among students (UNESCO, 2023).

In contrast, Nigerian teacher training programs have been slow to adopt environmental education, particularly in the area of waste management. This is partly due to a lack of resources, inadequate training materials, and limited awareness among educators about the importance of environmental sustainability (Jekayinfa & Yusuf, 2020). Furthermore, the curriculum in many teacher training institutions is heavily focused on traditional subjects, leaving little room for the inclusion of contemporary issues such as environmental education.

This study explores the perspectives of teachers who are on the front lines of education in Nigeria. By engaging with teachers through interviews and focus group discussions, the research will seek to uncover their views on the importance of waste management education, the challenges they face in integrating it into their teaching, and the support they need to effectively incorporate environmental sustainability into their classrooms. The qualitative nature of this study will allow for an in-depth exploration of teachers' experiences, providing rich insights into the practical realities of promoting environmental education in Nigeria.

Moreover, this research will contribute to the existing body of knowledge by highlighting the specific needs and concerns of Nigerian teachers regarding environmental education. It will also offer practical recommendations for policymakers, curriculum developers, and teacher training institutions on how to effectively integrate waste management education into teacher training

programs. By addressing the gap in the current curriculum, this study aims to empower teachers to become agents of change, capable of fostering a generation of environmentally conscious citizens who are committed to sustainable practices.

Statement of the Problem: The study focuses on the urgent need to address Nigeria's escalating environmental challenges, particularly in waste management. With the country generating over 32 million tons of solid waste annually and more than 70% of it improperly managed, the environmental and public health risks are severe. Despite these critical issues, the current teacher education curriculum in Nigeria lacks a strong focus on environmental sustainability, leaving future educators unprepared to instill essential waste management principles in their students.

Teachers play a pivotal role in shaping the values and behaviors of young people, making them essential agents for promoting environmental stewardship. However, without adequate training in waste management and sustainability, teachers cannot effectively pass on this knowledge. Integrating waste management education into teacher training programs is essential for fostering a culture of environmental responsibility among students, which is crucial for addressing Nigeria's waste management crisis.

Aims

The study explores pre-service teacher educators' perspectives on integrating waste management education into teacher training programs in Nigeria. Specifically, the study:

- a. Assess pre-service teachers' awareness and understanding of waste management and environmental sustainability concepts.
- b. Examine teachers' attitudes toward the inclusion of waste management content in the teacher training curriculum.
- c. Identify the support and resources available to teachers for effectively delivering waste management education.

Research Questions

The following research questions guided this study:

- a. Are pre-service teachers' awareness and understanding of waste management and environmental sustainability concepts?

- b. What are teachers' attitudes towards the inclusion of waste management content in the teacher training curriculum?
- c. What support and resources are available to teachers for delivering waste management education?

2. MATERIALS AND METHODS:

The procedure adopted in this study was presented as follows:

2.1. Research Design

This study employs a qualitative approach to explore the perspectives of pre-service teacher educators on incorporating waste management education into teacher training programs. The qualitative component offers in-depth insights into participants' experiences, attitudes, and challenges.

2.2. Population, Sample and Sampling Techniques

The target population for this study comprises pre-service teacher educators in North-Western Nigeria. A multi-stage sampling technique was adopted to ensure a representative selection of participants. Three Federal Colleges of Education were purposively selected from the eight available in the region, considering geographical representation and institutional commitment to environmental education. From these institutions, 45 pre-service teacher educators (ratio= 12: 24: 9 respectively) were selected for the qualitative component using simple random sampling. (Sambo, 2006). Participants were required to be actively engaged in teacher training programs and have an interest in environmental or waste management education

2.3 Instrumentation

A researcher-designed questionnaire, which contained unstructured items, was used to elicit comprehensive data collection. The questionnaire was administered via Google Forms for easy accessibility. The validity and reliability of the research instruments were ensured through content validity through expert reviews by professionals in environmental education and teacher training, ensuring that the instruments adequately captured the study's objectives. A pilot study was conducted with a small group of pre-service teacher educators outside the selected sample to refine the questionnaire and interview

guide based on feedback. The reliability of the questionnaire was assessed using Cronbach's Alpha, yielding a reliability index of 0.86, indicating a high level of internal consistency.

2.4. Data Collection

The data collection process involved distributing the questionnaire through pre-service teacher educators' online platforms and professional networks. Participants were given a specific timeframe to complete the questionnaire. Confidentiality was strictly maintained throughout the data collection process, and responses were anonymized before analysis.

2.5. Statistical Analysis or Data Analysis

The collected data were analyzed using qualitative techniques, transcribed, and analyzed using thematic analysis. This involved systematically identifying, analyzing, and interpreting patterns within the qualitative data. The analysis process included data familiarization, coding of significant statements, theme development, and synthesis into a comprehensive narrative.

2.6. Ethics or Ethical Guidelines

Ethical considerations were rigorously observed throughout the study. Formal ethical approval was obtained from the University Ethical Review Committee before data collection commenced. Participants were fully informed about the purpose of the study, their rights, and potential risks. Informed consent was obtained, ensuring that participation was voluntary and that individuals had the right to withdraw at any stage without consequences. Confidentiality and anonymity were strictly maintained, with all data securely stored and participants' identities anonymized in the final report.

3. RESULTS AND DISCUSSION:

3.1. Results

The findings of the study were presented as follows.

Here is the demographical distributions of the respondents.

Table 1: Distribution of Pre-Service Teacher Educators by School Affiliation across the sampled schools.

School	Frequency (n)	Percentage (%)
School of Education	10	22.2%
School of Sciences	9	20.0%
School of General Studies	9	20.07%
School of Vocational Education	8	17.8%
School of Arts/Languages	8	17.8%
Total	45	100%

Table 1 revealed the distribution of 45 pre-service teacher educators across five academic schools. The School of Education (22.2%) has the highest representation, followed by Sciences and General Studies (20.0%). Vocational Education and Arts/Languages (17.8%) are slightly lower. This diversity ensures balanced perspectives on waste management education.

Table 2: Gender Distribution of Pre-Service Teacher Educators

Gender	Frequency (n)	Percentage (%)
Male	27	60%
Female	18	40%
Total	45	100%

Table 2, indicates that a higher percentage of the pre-service teacher educators are male (60%) compared to female (40%). The total of 406 participants is the sum of both male and female educators. This gender distribution is important for understanding the demographic makeup of the study sample, and it may be relevant for analyzing any gender-based differences in perspectives, behaviors, or other factors within the research.

Research Question 1: Are pre-service teachers aware of and understanding of waste management and environmental sustainability concepts?

Research question one was presented using Atlas.ti and presented in Figure 1.

Figure 1 shows a flowchart that illustrates teachers' varying levels of awareness and understanding of waste management and environmental sustainability. It starts with a general awareness, branching into different levels of understanding. Some teachers demonstrate basic knowledge of waste practices like recycling

but lack a deeper comprehension of environmental impacts. Others struggle to integrate waste management into teaching despite personal familiarity. Many acknowledge a need for more training and resources. Some teachers understand waste disposal but are unsure of its connection to sustainability, while others are confident in waste management but require further knowledge on long-term environmental effects. A recurring theme is the limited understanding of sustainability concepts, leading to a widespread demand for professional development. The diagram highlights the necessity for targeted training to bridge knowledge gaps and improve teaching effectiveness, ensuring that educators can confidently link waste management practices to broader environmental issues like pollution prevention and climate change.

Research Question 2: What are teachers' attitudes towards the inclusion of waste management content in the teacher training curriculum?

The attitude of teachers was presented in Figure 2 after careful thematic and systematic coding.

Figure 2 illustrates teachers' attitudes toward including waste management in the curriculum. Most teachers strongly support its inclusion, emphasizing its role in fostering environmental responsibility and aligning with global sustainability goals. However, some express concerns about overcrowding the curriculum and integration challenges. A recurring theme is the need for proper training and resources to ensure effective teaching. Others stress that successful implementation depends on strategic planning, sufficient time, and institutional support. Overall, while there is broad support, addressing logistical and resource-related challenges is crucial for successfully incorporating waste management education into teacher training programs.

Research Question 3: What support and resources are available to teachers for delivering waste management education?

Figure 3 highlights teachers' concerns about the lack of support and resources for waste management education. Many educators report insufficient and outdated teaching materials, making effective instruction difficult. There is a strong need for practical, hands-on learning tools

to engage students. Due to inadequate institutional support, some teachers rely on external or self-created resources. Additionally, a lack of professional development opportunities and training workshops limits their ability to teach waste management comprehensively. Teachers emphasize the need for greater government and institutional support to provide updated materials, training, and collaborative efforts to enhance environmental education in schools.

3.2. Discussion

The findings of this study reveal critical insights into teachers' awareness and understanding of waste management and environmental sustainability concepts. While many educators demonstrate a foundational awareness of basic waste management practices, such as recycling and waste segregation, there exists a significant gap in their deeper understanding of how these practices relate to broader sustainability issues. This disconnect is crucial, as it directly impacts their ability to effectively teach these concepts to students, who are the future stewards of the environment.

One of the most striking aspects of the findings is the overwhelming support among teachers for the inclusion of waste management content in the teacher training curriculum. Educators recognize the importance of fostering environmental awareness and sustainability among students, aligning with global environmental goals. For instance, recent research by Lawal, M.B. & Mohammed, A.A. (Ed.) (1997) emphasizes that education for sustainability is essential for developing responsible citizens who can address environmental challenges. However, this enthusiasm is tempered by concerns regarding the already crowded curriculum. Teachers express a need for careful integration of waste management education to ensure it complements existing subjects rather than overwhelming them. This highlights a unique challenge in educational reform: balancing the introduction of essential new content with the constraints of current curricula.

Moreover, the study underscores the critical need for adequate resources and training to support teachers in delivering waste management education. Many educators report relying on outdated materials or creating their own resources due to a lack of institutional support. This reliance on self-generated materials can lead to inconsistencies in the quality of education provided, as not all teachers have the same level

of expertise or access to information. Recent research by Rodríguez-Guerreiro et al. 2. (2024) highlights the importance of providing high-quality resources for effective environmental education. The desire for more practical and interactive resources is a recurring theme, with teachers advocating for hands-on activities and real-life examples to engage students effectively. This finding is particularly novel, as it suggests that the current educational approach may not be sufficiently engaging for students, potentially leading to a lack of interest in environmental issues.

"The study also reveals a broader gap in environmental education, with many teachers acknowledging their limited understanding of the connection between waste management and sustainability. While some educators feel confident in their knowledge of recycling and waste disposal, they express a need for further training on sustainable resource use and pollution prevention. This indicates a critical area for professional development, as enhancing teachers' understanding of these concepts is essential for them to convey the importance of sustainability to their students. According to Yadav and Singh, (2021), professional development programs that focus on sustainability education can significantly enhance teachers' confidence and competence in teaching these topics."

Furthermore, the findings highlight the importance of teacher attitudes towards waste management education. Many teachers express a strong desire to include waste management in their curricula, recognizing its relevance to fostering a culture of sustainability in schools. This aligns with the work of Ogunyemi and Ifegbesan (2022), who argue that environmentally literate teachers are indispensable for sustainably addressing challenges in waste management education. However, several teachers raise concerns about how to fit this new content into an already crowded curriculum. This sentiment echoes the findings of Yilmaz et al. (2019), who emphasize that challenges such as crowded classrooms, lack of teaching resources, and insufficient support from school administration hinder effective environmental education practices.

The study also points to the necessity of collaboration between educational institutions and environmental organizations. Many teachers express a desire for more support and resources from external organizations to enhance their teaching of waste management. This collaboration can provide teachers with access to up-to-date

information, resources, and training opportunities. As highlighted by Galdames and Saracostti (2024), partnerships between schools and environmental organizations can enhance the quality of environmental education and provide valuable real-world connections for students.

The findings of this study highlight the urgent need for improved training, resources, and curriculum support for teachers in the area of waste management and environmental sustainability. The enthusiasm for including waste management in teacher training is evident, but it must be matched with practical support to ensure effective implementation.

4. CONCLUSIONS:

The study reveals a significant gap in teachers' understanding of waste management and its connection to environmental sustainability. While there is a basic awareness of waste management practices, many educators lack the depth of knowledge necessary to teach these concepts effectively. The findings underscore the importance of integrating waste management education into teacher training curricula while providing adequate resources and support to facilitate this process. Based on this, it was recommended that:

- Educational authorities should prioritize integrating waste management and sustainability into teacher training programs, creating a structured curriculum that balances these topics with existing subjects.
- Schools must invest in updated, relevant teaching materials, including interactive tools and hands-on activities, to help teachers convey complex concepts effectively.
- Establish regular training sessions and workshops to enhance teachers' understanding of waste management, focusing on practical applications and real-world implications.
- Schools should partner with environmental organizations to provide ongoing support and resources, bridging theoretical

knowledge and practical classroom application.

5. DECLARATIONS

5.1. Study Limitations

The relatively small sample size of 120 serum and urine samples may limit the generalizability. Exclusion criteria omitted participants with certain health conditions, potentially introducing bias. The cross-sectional design prevents establishing causal relationships—reliance on self-report measures, which may introduce measurement error. Potential confounding variables were not accounted for in the statistical analysis. Lack of control for external factors.

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5.4. Competing Interests

The authors declare that they do not have any potential conflict of interest in this publication.

5.5. Open Access

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6. HUMAN AND ANIMAL-RELATED STUDIES

6.1. Ethical Approval

This study received ethical approval from the University of Ilorin Ethical Review Committee (UERC), Ilorin, Nigeria, with approval number UERC/ASN/2024/2952. The approval was granted on 10/10/2024, valid until 09/10/2027, according to protocol identification UERC/EDU/431. The study strictly followed all institutional ethical guidelines established by the committee, ensuring research integrity and participant protection.

6.2. Informed Consent

All participants in this study signed an Informed Consent Form before they participated in accordance with the requirements of the University's Ethical Review Committee. The document clearly informed participants about the purpose of the study, the procedures involved, potential risks and benefits, and their right to withdraw from the research at any time without consequences. Participants were guaranteed complete confidentiality and anonymity, with the collected data being used exclusively for academic and publication purposes. Participation was entirely voluntary, and participants confirmed their consent by signing the standardized form, which was filed according to institutional ethical guidelines.

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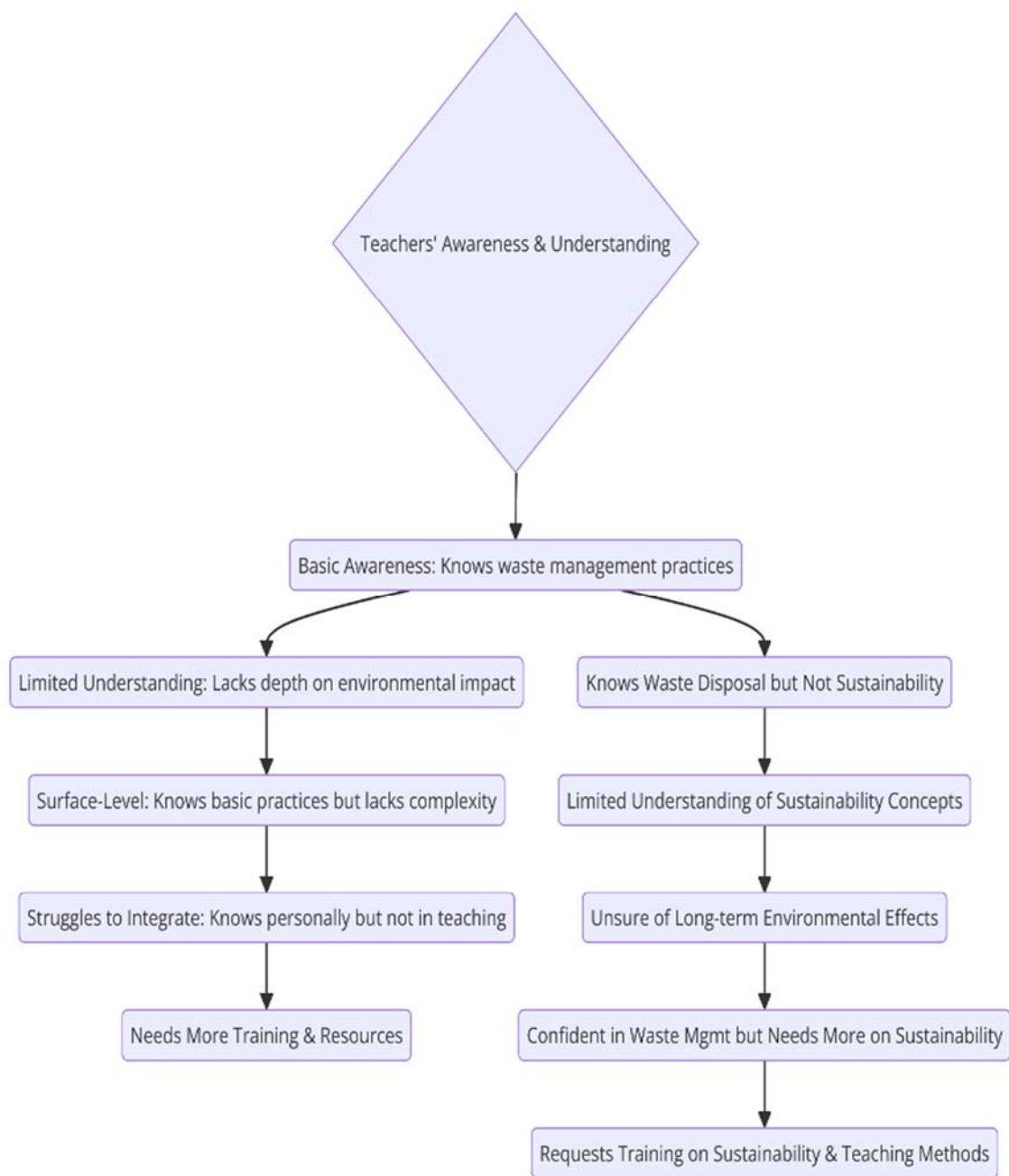


Figure 1: A flowchart diagram illustrating teachers' awareness of waste management and sustainability

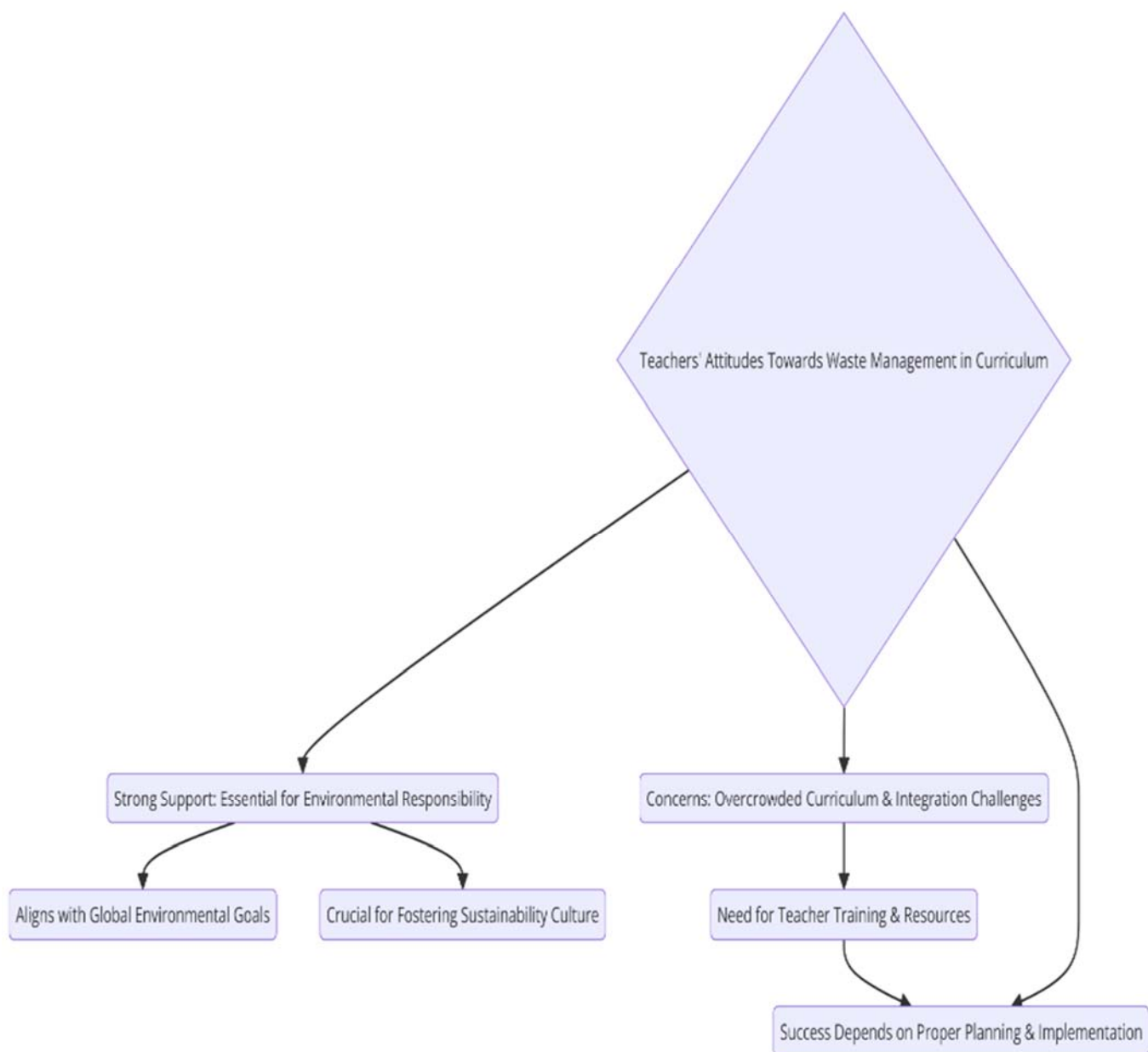


Figure 2: A flowchart diagram illustrating teachers' attitudes toward waste management content inclusion

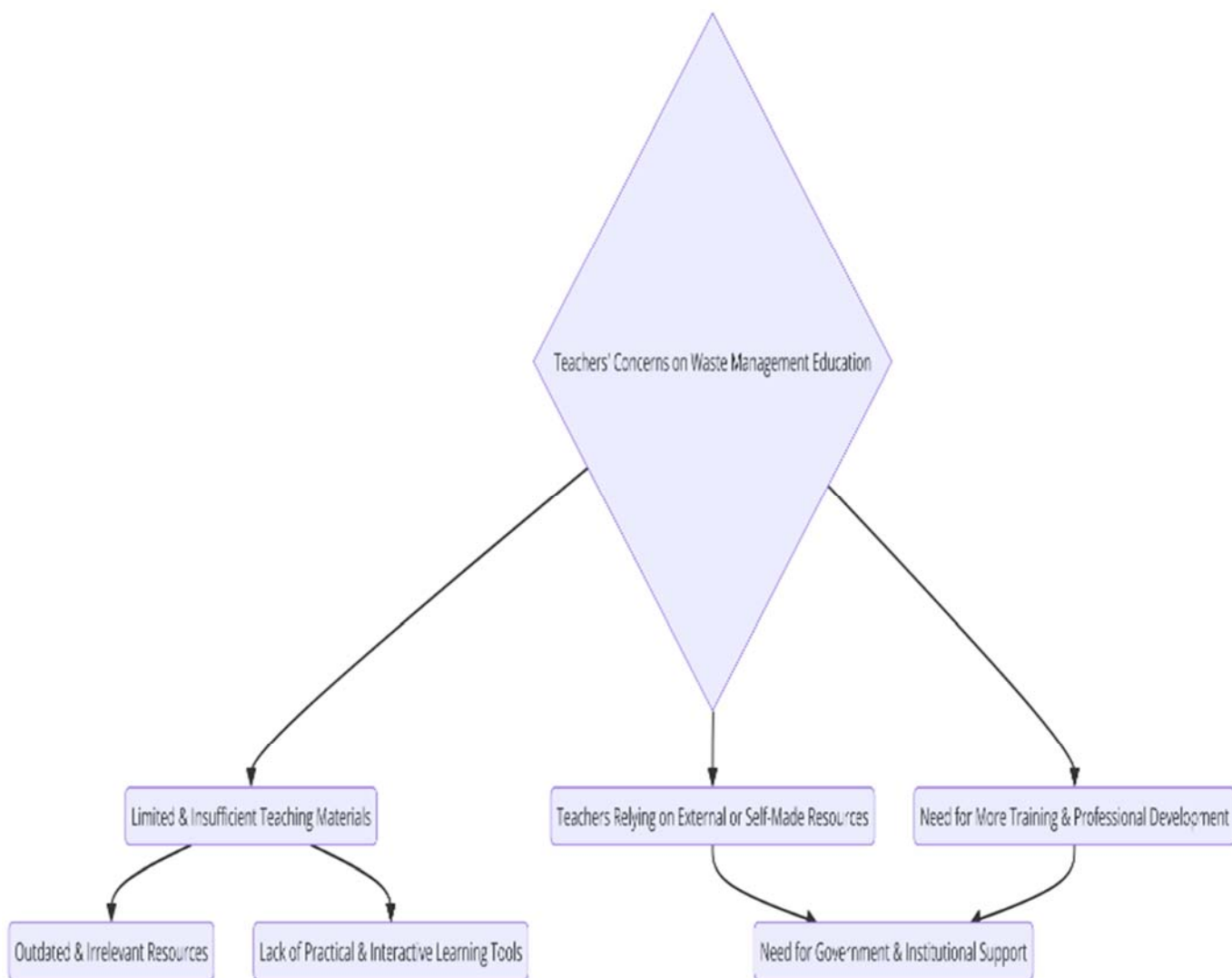


Figure 3: Flowchart illustrating the support and resources available for waste management education