



ISSN: 2617-6548

URL: www.ijirss.com



Social leadership and educational transformation enhance green school culture, overcoming challenges for teachers and management

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Abstract

This study investigates the role of social leadership and educational transformation in fostering an environmentally friendly school culture across 40 high schools in Banda Aceh City, Indonesia. It examines the challenges that principals, teachers, and management staff face in implementing environmental programs. The data were collected using a qualitative approach through in-depth interviews and focus group discussions with key participants, including principals, teachers, and school administrative staff. Field observations were also conducted to deepen the understanding of eco-friendly practices in these schools. Findings reveal that strong social leadership and educational transformation encourage school-wide participation in sustainable initiatives. Proactive principals with a vision for sustainability integrate environmental practices into curricula and daily activities. However, the study also highlights challenges such as limited resources, high teacher workloads, and insufficient training in environmental education. School management faces difficulties in consistently crafting policies that support sustainable practices. Collaboration among teachers, students, and management is crucial for addressing these barriers and establishing greener school environments. The study finds that effective social leadership and transformative management are essential for fostering environmentally conscious schools. At the same time, a holistic approach is necessary to overcome the challenges associated with implementing sustainable programs.

Keywords: Educational transformation, Environmental school culture, School management, Social leadership, Teacher motivation.

DOI: 10.53894/ijirss.v8i3.6947

Funding: This study received no specific financial support.

History: Received: 24 March 2025 / Revised: 25 April 2025 / Accepted: 28 April 2025 / Published: 12 May 2025

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Competing Interests: The authors declare that they have no competing interests.

Authors' Contributions: All authors contributed equally to the conception and design of the study. All authors have read and agreed to the published version of the manuscript.

Transparency: The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

Acknowledgment: Thank you to all high schools and equivalent schools in the city of Banda Aceh who have facilitated this research and the contribution of school leaders and education managers in the city of Banda Aceh.

Publisher: Innovative Research Publishing

1. Introduction

Climate change and environmental damage are urgent global issues that affect various aspects, including education. UNESCO (2017) emphasized the importance of integrating environmental education into the worldwide education system to combat climate change [1]. Countries such as Japan, South Korea, and Singapore have integrated environmental education into school curricula in Asia [2]. In Indonesia, ecological issues are increasingly relevant to the high forest destruction and natural disasters. Through the Adiwiyata program, the government encourages schools to implement environmentally friendly principles [3]. In Aceh, the impact of the 2004 tsunami and climate change risk makes it important to develop an environmentally friendly school culture to sustain education and disaster mitigation [4].

Modern education today emphasizes academic achievement and the development of social and environmental awareness [5]. Integrating environmental sustainability in the education system reflects a new paradigm emphasizing character building, environmental concern, and social responsibility. Schools in the modern era should be central to developing eco-friendly values, where students learn to preserve the environment through concrete actions [6]. Social leadership and educational transformation are essential in fostering an eco-friendly school culture. School leaders with a sustainability vision can mobilize the entire school community to participate in various environmental initiatives, from implementing green policies to integrating sustainability-based curricula [7]. This educational transformation changes the way of teaching and the way students and teachers view the environment.

Previous research has shown that sustainability-focused social leadership and education significantly impact changing school culture [8]. A study by Fredriksson, et al. [9] in Sweden showed that the integration of sustainability education in school curricula increased environmental awareness among students and staff [10], while Vaughter, et al. [11] in Canada found that collaboration between teachers, students, and the school community strengthened the effectiveness of sustainability programs [12]. In Indonesia, Zaliyanti and Azani [13] research in East Java shows that the proactive leadership of school principals in the Adiwiyata program is essential in successfully implementing an environmentally friendly school culture [14]. However, studies on social leadership and educational transformation in regions such as Aceh are still minimal, even though environmental issues are very relevant [15].

The urgency of this research lies in the importance of social leadership and educational transformation in creating environmentally friendly schools, especially in Aceh, which is vulnerable to natural disasters. This research aims to identify the challenges teachers and school management face in adopting an eco-friendly culture and how social leadership facilitates the transformation. With a qualitative approach, this study is expected to provide strategic guidance for school administrators in Aceh and other regions to develop sustainable education policies. The dynamics of green culture adoption are influenced by leadership support, community involvement, and resource availability. Although schools with limited resources face challenges, effective social leadership enables a transformation towards a modern educational paradigm that puts sustainability at the core of its vision and mission.

2. Literature Review

Social leadership in schools plays an essential role in creating a culture that supports environmental sustainability. In South Korea shows that proactive leadership in integrating sustainability education into school curricula can increase student and staff awareness of environmental issues [16]. In contrast, Hong Kong reveals that leadership collaborating with school communities can strengthen environmental programs through sustainable social support and policies [17]. In Indonesia, the role of school principals in the Adiwiyata program, where proactive leadership, played a significant role in successfully implementing an environmentally friendly school culture [18]. All researchers assert that effective social leadership focuses on policy formulation and actively empowering school communities to participate in environmental efforts.

Teachers play a central role in adopting and implementing eco-friendly programs in schools, but they often face various challenges [19]. One of the most prominent challenges teachers face is the lack of specialized training in sustainability education, which limits their ability to integrate environmental issues into the curriculum [20]. In Indonesia also shows that limited school resources and facilities are the main obstacles for teachers in carrying out environmental programs [21]. A local highlights the logistical challenges teachers face, such as a lack of support from school management and a high workload, which hinders their ability to focus on environmental initiatives [22].

School management is crucial in providing an environment conducive to developing an eco-friendly school culture [23]. Preview research in Australia found that school management that successfully integrates sustainability policies across the board, such as energy efficiency and waste management, tends to create a more robust school culture regarding sustainability [24]. In Asia, proper budget allocation and adequate infrastructure support greatly influence the success of school environmental programs [25]. Indonesia has shown the importance of local government policies in providing funding and training to support school sustainability initiatives [26].

Collaboration between teachers, students, and school management is essential to creating the success of environmental programs in schools [27]. A study in the United Kingdom shows that when all parties in the school work together, there is an increase in student involvement and awareness of environmental issues [28]. Another thing in the United States found that grant initiatives that involve the active participation of students and teachers, supported by management, are more successful

than initiatives that are only led by one party [29]. Cross-community collaboration in the *Adiwiyata program* is also the main factor in implementing an environmentally friendly culture [30].

3. Methodology

3.1. Research Design

This study uses a qualitative method with a case study approach to explore the role of social leadership and educational transformation in improving environmentally friendly school culture. This approach provides an in-depth understanding of the social and organizational dynamics in high schools (SMA) and equivalents in Banda Aceh, Indonesia, which are involved in environmental sustainability programs. The selection of the research site in Banda Aceh was based on the relevance of the local context, where environmental issues and the impact of natural disasters, such as the 2004 tsunami, influenced the development of a sustainability-oriented school culture.

3.2. Research Subject

This study involved 400 subjects from various elements of the school and stakeholders, including 150 teachers, 50 school leaders (principals and vice principals), 50 education stakeholders, 50 school committee members, and 100 parents/guardians. The research subjects were selected using a purposive sampling technique, in which respondents were chosen based on their roles relevant to the issues of social leadership and educational transformation in schools involved in environmental programs.

3.3. Research Instruments

The research instruments used include several methods. In-depth interviews were conducted with school leaders, teachers, and education stakeholders to explore the role of social leadership and challenges in adopting an eco-friendly culture in schools. Focus Group Discussions (FGDs) were conducted with school committees and parents/guardians to understand their perceptions of school environmental programs and their role in supporting educational transformation. Researchers carried out participatory observation to observe school activities related to environmental programs, such as implementing environmentally friendly policies and involving students and teachers. In addition, documentation is also collected through official school documents, environmental policies, and *green school* program reports to support research findings.

3.4. Data Collection Procedure

The data collection procedure in this study is carried out through several stages. In-depth interviews were conducted semi-structured with teachers, school leaders, and education stakeholders, using interview guidelines developed based on research objectives. Focus Group Discussions (FGDs) were conducted separately for the school committee and parents/guardians, with 10-12 participants, guided by the moderator to keep the discussion focused. Observations were carried out in the schools involved to record activities related to the environment, such as using renewable energy and waste management. In addition, documentation in the form of school environment policies and programs is collected to strengthen research findings and provide supporting data.

3.5. Data Analysis

The data in this study were analyzed using thematic analysis techniques through three stages: Open coding, which identified the initial themes of the interview and FGD; axial coding, which groups related codes to find key themes such as social leadership roles, challenges, and educational transformation strategies; and selective coding, which integrates critical themes to build a theoretical framework regarding the dynamics of social leadership and the culture of green schools.

3.6. Validity and Reliability

The validity of the data is ensured through the triangulation of sources, methods, and theories, where interviews, FGDs, observations, and documentation are used to strengthen the validity of the results. Feedback from participants was also obtained to verify the interpretation of the data, thus ensuring that the study's results were trustworthy and accurate.

3.7. Results

The results of this study show that social leadership plays an essential role in creating an environmentally friendly school culture by motivating the school community through a clear vision of sustainability. Teachers' main challenges in implementing eco-friendly programs are limited resources, workload, and lack of specialized training. School management supports this transformation through appropriate policies, resource allocation, and environmentally friendly infrastructure development. Collaboration between teachers, students, and management has proven effective in overcoming these barriers, strengthening the implementation of environmental programs, and increasing the involvement of the entire school community.

3.8. Research Respondent

From the results of univariate analysis, most research subjects were men (77.5%), while women were only 22.5%, showing a significant gender imbalance. In terms of education, most subjects are educated with a Bachelor's degree (85%), followed by a Master's (15%) and Doctorate (10%), showing an excellent educational background, although further education is still relatively few. Most of the subjects were in the age range of 26-45 years (47.5%), the productive age group, with the

age groups of 46-55 years (25%) and 23-25 years (17.5%) also contributing significantly. In terms of roles, teachers (37.5%) have the most significant representation, followed by Parents/Guardians (15%), with School Leaders, Education Stakeholders, and School Committees at 12.5%, respectively, and Administrative Staff at 10%. This shows that teachers play an important role in transforming school culture. At the same time, the involvement of women and administrative staff is still limited, which can influence the research perspective on social leadership and sustainability issues in schools.

3.9. Data Validity and Reliability

Figure 1 illustrates the steps for Triangulation Analysis and Participant Feedback to enhance data validity in qualitative research. Triangulation Analysis includes determining the type of triangulation, collecting data from multiple sources, analyzing data separately, integrating findings, and validating with theory. Participant Feedback involves identifying key findings, selecting and inviting key participants, preparing a summary of findings, collecting participant feedback, and integrating feedback into the final analysis. Both methods ensure research credibility by combining diverse data sources and direct participant input. Table 1 confirms the validity and reliability of research data through source, method, theory triangulation, and participant feedback. This approach allows for a deeper interpretation and confirms analysis results with support from various participant perspectives.

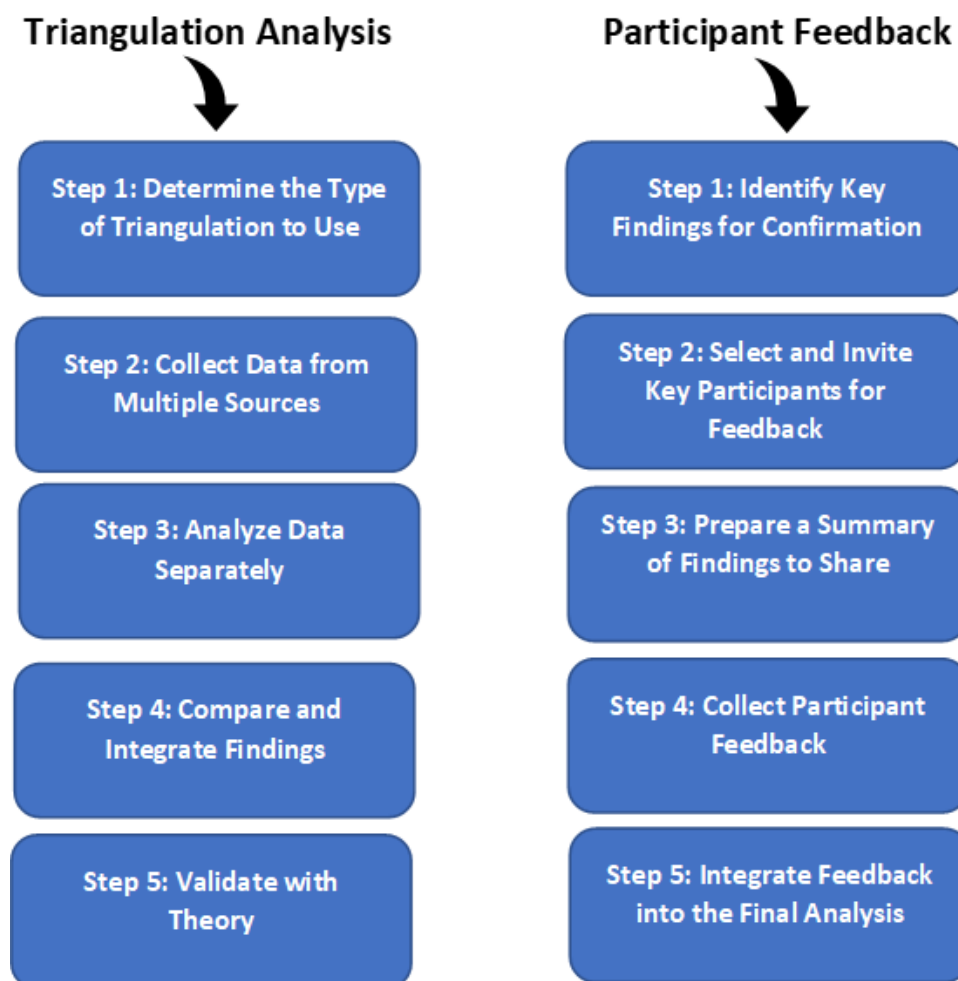


Figure 1.
Triangulation analysis steps and participant feedback for the validity and reliability of research data.

Table 1.

Validity and reliability of research data.

Research Topics	Source Triangulation	Triangulation Methods	Triangulation Theory	Participant Feedback
1. The Role of Social Leadership in Building an Eco-Friendly School Culture	Data was collected from principals, teachers, and students, as well as policy documentation and direct observation.	Use interviews, observations, and policy documentation analysis to assess leadership's role in implementation.	Social and participatory leadership theories support the analysis of the role of leadership in fostering environmental culture.	Principals and teachers provide feedback on the researchers' interpretations, ensuring an understanding of their leadership roles.
2. Educational Transformation in Supporting School Sustainability	Data from teacher interviews, FGDs with students, and curriculum and environmental education program documentation.	Using interviews, FGDs, and analysis of curriculum documents that include sustainability education in teaching.	The theory of educational transformation and environmental education supports the analysis of the integration of sustainability education in schools.	Teachers provide feedback on interpretations regarding educational transformation, confirming or correcting the analysis.
3. Challenges Faced by Teachers in Implementing Eco-Friendly Programs	Interviews with teachers and management, as well as observation of the environmental facilities available at the school.	Using interviews, direct observations, and documentation of environmentally friendly supporting facilities.	Workload theory and operational constraints support the analysis of challenges faced by teachers.	Teachers confirm the interpretation of the challenges, such as workload and limited facilities.
4. The Role of School Management in Supporting Sustainability Programs through Policy and Infrastructure	Data from school management, teachers, policy documents, and budget allocation reports for environmental programs.	Using interviews, facility observations, environmental policy analysis, and budget documentation.	Educational management theory and environmental policy support the analysis of the role of management in implementing sustainability.	The school management confirmed the interpretation regarding policy support, budget allocation, and environmental infrastructure.
5. Collaboration Between Parties as the Key to the Success of the School Environment Program	Data from interviews with teachers, students, parents, and school committees, as well as documentation of collaborative programs.	Using interviews, FGDs, and collaboration documentation between parties in the school environment program.	The theory of community involvement and collaboration supports the analysis of the role of cooperation in the success of environmental programs.	All parties provide feedback on the role of collaboration, ensuring that the analysis reflects their perception of collaboration.

4. Research Findings

4.1. The Role of Social Leadership in Building an Eco-Friendly School Culture

Interviews with principals revealed that social leadership is crucial in encouraging the participation of the entire school community to create an eco-friendly culture. Proactive principals apply a participatory approach, involving teachers, students, and staff in decision-making related to environmental policy, creating a sense of shared ownership. In a group discussion (FGD), teachers and students stated that the principal is a role model in implementing environmental programs, creating a shared responsibility for school cleanliness and sustainability. Participatory observations show that principals are actively involved in environmental activities, such as recycling and greening campaigns, encouraging student and teacher engagement. School policy documentation and environmental activity reports note that the role of leadership in formulating and supporting the implementation of sustainability policies has a significant impact on creating an environmentally friendly culture in schools.

4.2. Educational Transformation in Supporting School Sustainability

Interviews with teachers revealed some difficulties and successes in integrating environmental values into the curriculum. This educational transformation is important to increase students' awareness of sustainability issues, although some teachers need further training. In the FGD, students expressed their understanding of the importance of environmental

education but wanted more interactive methods and practical applications in daily activities. Observations show that some teachers successfully integrate environmental materials into the subject, while others face challenges and require skill improvement. Documentation of curriculum and educational programs in schools shows that there are efforts to include sustainability materials in learning. However, their implementation still needs to be improved to achieve more comprehensive sustainability.

4.3. Challenges Faced by Teachers in Implementing Green Programs

Interviews with teachers show that high workloads and limited facilities are the main obstacles to green programs. Teachers find additional assignments related to environmental programs often difficult to manage outside of their primary teaching responsibilities, and the lack of training also makes some teachers feel unprepared. In the FGD, teachers shared their experiences of these challenges and expressed the need for additional facilities and support. Observations show that some teachers struggle to facilitate eco-friendly programs outside the main teaching schedule effectively. The school's documentation also notes the limitations of resources and facilities that support environmentally friendly activities, which hinders the program's overall implementation and has an impact on its effectiveness.

4.4. The Role of School Management in Supporting Sustainability Programs through Policy and Infrastructure

Interviews with school management revealed their commitment to providing budgets and facilities for environmental programs, such as the installation of solar panels, the provision of recycling areas, and green parks. Teachers and students in the FGD noted that management support is significant, especially in providing infrastructure that enables the implementation of environmental activities in schools. Observations in the school environment show that eco-friendly facilities provided by management, such as green gardens and recycling areas, are very helpful in implementing sustainability programs. Policy documentation and budget allocations note support from school management in providing resources for eco-friendly activities, reinforcing their commitment to school sustainability.

4.5. Collaboration Between Parties as the Key to the Success of School Environment Programs

Interviews with various parties, including teachers, students, and parents, show that collaboration is a key factor for the success of environmental programs. All parties stated that effective collaboration creates a sense of shared responsibility in maintaining the cleanliness and sustainability of the school. In the FGD with the school committee and parents, they supported the school's environmental policy and actively participated in greening and hygiene campaigns. Observations in schools show the active involvement of students, teachers, and parents in various environmental activities, which strengthens the eco-friendly culture in schools. Documentation of collaborative activities notes the participation of the entire school community and the ongoing support of various parties, showing that cross-stakeholder collaboration is a factor that ensures that environmental programs can take place consistently and sustainably.

5. Thematic Analysis

5.1. The Role of Social Leadership in Building an Eco-Friendly School Culture

Table 2 provides an overview of how social leadership influences school culture through various strategies, participatory models, influences on school community behavior, and inspirational communication patterns. Each theme and sub-theme plays a role in creating and strengthening an eco-friendly school culture.

Table 2.

Thematic analysis of the role of social leadership in building an environmentally friendly school culture.

Main Theme	Sub-Theme	Description	Findings
Leadership Strategy	School Community Motivation	Principals and other leaders use motivational approaches to encourage the active participation of the school community in eco-friendly programs.	The principal motivates teachers and students by giving awards to the most active classes in environmental activities.
	Community Engagement	School leaders hold activities that involve the entire school community, including students, teachers, staff, and parents in sustainability programs.	Holding monthly environmental service activities involving students, teachers, and school staff.
Participatory Leadership Model	Participatory Approach	School leaders use an approach that involves teachers, students, and parents in the environmental policy formulation process.	Involve student and teacher representatives in the environmental policy formulation team in schools.
	Joint Policy Implementation	Environmental policies are implemented collectively with the school community's support through a participatory approach.	Students, teachers, and staff participate in implementing recycling and reducing plastic use programs in schools.
Influence on School Culture	Changes in Student Behavior	Social leadership positively impacts changing student behavior in support of environmental and sustainability activities in schools.	Students began to reduce the use of plastic bottles and bring their drinking bottles more often.
	Teacher and Staff Commitment	Effective leadership inspires teachers and staff to support and commit to school sustainability programs.	Teachers actively participate in tree-planting programs with students and the community in the school environment.
Communication and Inspiration Patterns	Delivering the Sustainability Vision	School leaders convey their sustainability vision in a clear and inspiring way that is easy for the school community to understand.	On Monday, the principal gave an inspirational speech about safeguarding the environment at every flag ceremony.
	Ongoing Motivation	School leaders continue to motivate the school community through consistent communication about the importance of sustainability.	School principals routinely convey information related to sustainability in teacher meetings and through school bulletin boards.

5.2. Educational Transformation in Supporting School Sustainability

Table 3 provides an overview of how educational transformation supports school sustainability by integrating environmental materials into the curriculum, teaching methodologies that support sustainability, changes in educational values, and success evaluation. Each theme and sub-theme shows the contribution of educational transformation in increasing environmental awareness among students.

Table 3.

Thematic analysis of educational transformation in supporting school sustainability.

Main Theme	Sub-Theme	Description	Findings
Integration of Environmental Materials in the Curriculum	Environmental Education in the Curriculum	Environmental education is integrated into the school curriculum through subjects such as Science, Social Studies, and Civic Education.	Science subjects discuss ecosystems and the impact of plastic waste on the environment.
	Enrichment of Extracurricular Materials	Extracurricular activities include environmental materials to increase students' understanding outside of formal learning.	Extracurricular activities such as environmental clubs and community service are carried out periodically to support environmental education.
Teaching Methodologies that Support Sustainability	Interactive Teaching Techniques	Teachers apply interactive teaching techniques such as group discussions and case studies to improve students' understanding of the environment.	Teachers use the discussion method to encourage students to discuss how to reduce waste in schools.
	Project-Based Learning Approach	Students are involved in relevant environmental projects to reinforce the concepts of sustainability and environmental responsibility.	Classroom projects involve students planting trees or creating recycling systems in schools.
Changes in Educational Values and Practices	Sustainability-Based Education Philosophy	Schools began to adopt the value of sustainability in their educational philosophy, emphasizing the importance of the environment in its vision and mission.	The school lists sustainability as one of the core values of its educational mission.
	Educational Practices That Drive Sustainability	Educational practices include concrete actions, such as reducing the use of plastics and waste management practiced by the school community.	Teachers and students work together to reduce the use of plastic in schools and use recycling bins.
Transformation Success Evaluation	Environmental Education Impact Measurement	The school evaluates students' awareness of environmental issues after implementing the environmental education program.	Students are given a questionnaire to assess their understanding of the importance of sustainability after a few months of the program.
	Increasing Student Awareness and Behavior	The evaluation of the success of the transformation showed an increase in student awareness and a change in behavior towards environmentally friendly practices.	Students began to apply the habit of saving water and energy and were active in school environmental activities.

5.3. Challenges Faced by Teachers in Implementing Eco-Friendly Programs

Table 4 provides an overview of the challenges teachers face in implementing green programs, ranging from limited infrastructure, additional workloads, and a lack of training and resources to resistance and support from the school community. Each theme and sub-theme reflects the specific obstacles experienced by teachers in running environmental programs and integrating them into education.

Table 4.

Thematic analysis of challenges faced by teachers in implementing environmentally friendly programs.

Main Theme	Sub-Theme	Description	Findings
Infrastructure Limitations	Limited Green Space	Schools experience infrastructure barriers, such as a lack of green areas to support environmental programs.	The teacher stated that the school only has a small amount of green area, making it difficult to implement greening activities optimally.
	Inadequate Recycling Facilities	Lack of supporting facilities, such as recycling bins and effective waste management systems.	The absence of special recycling bins makes waste reduction programs less effective in schools.
Teacher Workload	Additional Tasks Beyond Teaching	Teachers' workload increases because environmental programs require additional time and attention outside of teaching duties.	Teachers find it difficult to run environmental programs because they already have a busy teaching schedule.
	Time Management for Environmental Programs	Difficulty in dividing time between the main teaching task and activities that support the environmental program.	Teachers must sacrifice rest time for environmental activities, such as supervising the cleaning area.
Lack of Training and Resources	Lack of Environment-Related Training	Teachers do not get enough training to integrate environmental education into learning.	Teachers feel less confident in teaching environmental issues because they have never participated in special training.
	Limitations of Supporting Materials	Lack of resources or supporting materials to support environmental education in the classroom.	Schools do not provide adequate modules or teaching materials on environmental issues to support teachers.
Resistance and Support	Resistance from Students and Parents	Challenges arise because some students or parents are indifferent or reject environmental programs.	Some parents feel that environmental programs are unimportant and a burden on their children.
	Support Level from the School Community	The level of support from the school community affects the success of the environmental programs implemented by teachers.	Teachers feel helped when the school community, including parents and students, fully supports the environmental program.

5.5. The Role of School Management in Supporting Sustainability Programs through Policy and Infrastructure

Table 5 provides an overview of the role of school management in supporting sustainability programs through policies and infrastructure. Management plays an essential role in setting green policies, allocating budgets, providing infrastructure, and taking a collaborative approach in policy formulation and implementing environmental initiatives. Each theme and sub-theme describes management's efforts to create a more sustainable school environment and support an eco-friendly culture.

Table 5.

Thematic analysis of the role of school management in supporting sustainability programs through policies and infrastructure.

Main Theme	Sub-Theme	Description	Findings
Green Policy	Structured Environment Policy	The school management establishes policies and procedures that support sustainability, such as waste reduction and the use of green energy.	The school has a zero-waste policy requiring all residents to reduce the use of single-use plastics.
	Sustainability Procedures	Operational procedures in schools that emphasize environmentally friendly practices in daily and school activities.	The school implements organic and inorganic waste separation procedures in all school areas.
Budget and Resource Allocation	Allocation of Funds for Environmental Programs	Management allocates a special budget to support environmental programs, including activities and procurement of environmental facilities.	The school allocates annual funds for greening activities and maintenance of the school's green areas.
	Resource Provisioning	Resources allocated by management to support environmental education and sustainability programs in schools.	Schools provide resources such as educational posters and props for environmental education activities in the classroom.
Provision of Environmental Infrastructure	Renewable Energy Facilities	Management provides infrastructure to support eco-friendly programs, such as solar panels and recycling systems.	The school installed solar panels on the roof of the building as an effort to use renewable energy.
	Green Spaces and Conservation Areas	Green spaces or school gardens should be provided as conservation areas and environmental education facilities for students.	The school has a green garden that is used for outdoor learning activities and tree planting activities.
Management Collaborative Approach	Collaboration in Policy Formulation	Management works closely with teachers, staff, and school committees to formulate more inclusive and effective environmental policies.	The principal involves teachers and staff in formulating environmental policies through regular meetings and discussion sessions.
	Collaborative Support for Initiatives	Management supports environmental initiatives that teachers or students propose by providing facilities and administrative support.	The management fully supports the students' initiative to create a vertical garden in the schoolyard.

5.6. Collaboration Between Parties as the Key to the Success of the School Environment Program

Table 6 illustrates how collaboration between teachers, students, management, parents, school committees, and external communities plays an essential role in the success of school environmental programs. Each theme and sub-theme indicates each party's specific contribution and its impact on the sustainability of the environmental program. The evaluation of the impact of the collaboration also shows that effective cooperation supports the sustainability of the long-term program, creating an environmentally friendly school culture.

Table 6.

Thematic analysis of collaboration between parties as the key to the success of the school environment program.

Main Theme	Sub-Theme	Description	Findings
Collaboration of Teachers, Students, and Management	Collaborative Roles and Responsibilities	A form of cooperation between teachers, students, and school management in carrying out environmental programs, with their respective roles and responsibilities.	Teachers lead environmental projects, students are involved in implementation in the field, and management provides facilities and budgets.
	Cooperation in Environmental Programs	Active collaboration between parties in environmental activities, such as greening, waste management, and environmental education.	Teachers and students work together to plant trees in the school area, with financial support from the school management.
Parent Involvement and School Committees	Financial and Moral Support	Parents and school committees play a role in providing financial and moral support for environmental programs held by schools.	Parents donate funds to recycling facilities, and school committees hold environmental campaigns in the community.
	Participation in School Activities	Parents and school committees participate in environmental activities held by the school, assisting in the supervision and implementation of programs.	Parents participate in community service work with students on weekends.
The Role of External Communities	Cooperation with Environmental Organizations	Collaboration with environmental organizations or government agencies to support school environmental programs through training or donations.	The school works closely with environmental organizations to train students and teachers in recycling.
	External Resource Help	Support for resources from external communities, such as facility assistance or environmental education resources for schools.	Government agencies provide special recycling bins for schools as part of environmental initiatives.
Evaluate the Impact of Collaboration	Measuring Collaboration Effectiveness	Evaluate the effectiveness of collaboration between parties on the success of school environmental programs.	The evaluation results showed increased students' environmental awareness and the sustainability of school environmental programs.
	Impact on Program Sustainability	Measuring the long-term impact of collaboration on the sustainability of school environmental programs.	Environmental programs involving various parties can continue running consistently yearly because of mutual support.

Source: Primary data 2024



Figure 2. Green School program at a high school in Banda Aceh. (A) socialization and mentoring, (B) cleaning activities at school, (C) view of the school yard, (D) location of the rest gathering place. (Photo taken with Creative Commons license, 2024)

Figure 2 shows various initiatives in the *Green School program* implemented in several high schools in Banda Aceh. In panel **A**, socialization and mentoring activities held by schools and related institutions can be seen to educate students about the importance of protecting the environment and preserving nature. Panel **B** shows hygiene activities, where students and teachers come together to collect plastic waste for recycling, demonstrating the active participation of the school community in sustainability programs. Panel **C** shows the appearance of a green and beautiful schoolyard, emphasizing the importance of greening and good environmental governance in schools. Meanwhile, in panel **D**, the location of the student gathering place is displayed, designed in such a way that a green area supports the creation of a healthy and environmentally friendly learning atmosphere. These photos were taken with a *Creative Commons License* in 2024, illustrating the school's efforts to create a sustainable environmental culture.

5.6. Lessons Learned from the Research

Social Leadership Plays a Key Role in Promoting a Culture of Sustainability: Proactive and participatory leadership fosters an environment that values environmental sustainability. School principals who lead by example motivate teachers, students, and staff to engage in green initiatives actively. Their direct involvement inspires the school community, creating a shared commitment to sustainability. This hands-on approach empowers everyone to contribute to environmental programs, embedding sustainability in the school's culture and practices.

Collaboration Among Stakeholders Enhances the Effectiveness of Environmental Programs: By uniting teachers, students, school management, parents, and external communities, sustainable support for these initiatives is established. Each group brings unique perspectives and resources, enriching the program's impact. Cross-stakeholder cooperation actively engages all school components, from daily classroom activities to larger community initiatives. This collective involvement fosters a shared responsibility for environmental efforts, ensuring that programs are well-implemented and have a lasting impact. Through such collaboration, the school community strengthens its commitment to sustainability, embedding eco-friendly practices into school culture and everyday operations.

Operational Challenges for Teachers in Implementing Environmental Programs: Teachers encounter significant challenges when implementing school environmental programs, often managing these initiatives alongside heavy workloads and limited infrastructure. Many educators lack sufficient training to integrate environmental content effectively, which can impact program quality and reach. These barriers make it difficult for teachers to balance their regular teaching duties with additional responsibilities tied to sustainability initiatives. Support from school management is crucial in alleviating these challenges, whether through providing necessary resources, further training, or creating designated time for environmental activities. Specific training programs can empower teachers with practical skills and knowledge, enhancing their confidence and effectiveness in environmental education. Addressing these operational barriers is essential to ensure teachers are well-equipped to promote sustainability within the school environment.

The Role of School Management in Providing Environmentally Friendly Infrastructure: School management's dedication to providing sustainable infrastructure, including solar panels, green spaces, and recycling facilities, is crucial in advancing environmental programs. This commitment ensures that sustainability goals are backed by tangible resources, creating a supportive environment for students and staff to engage in eco-friendly practices. School management sets a standard for sustainable operations and expectations within the school community by establishing clear environmental policies. Allocating dedicated budgets for these initiatives further strengthens the program's impact, allowing for consistent maintenance and expansion of sustainable projects. This strategic investment from school management is valuable, illustrating how structured support and resources can lead to lasting success in school-based environmental programs.

The Importance of Impact Evaluation for Program Sustainability: Evaluating the impact of environmental programs is essential for sustaining their effectiveness and relevance. Through impact evaluation, schools can measure how well collaboration among stakeholders supports program goals and pinpoint areas needing improvement. This process provides valuable insights into the strengths and weaknesses of current initiatives, enabling schools to make informed adjustments. Regular evaluation also helps adapt these programs to evolving needs, ensuring they remain meaningful and effective for the school community. By prioritizing ongoing assessment, schools can foster a culture of continuous improvement, supporting long-term sustainability and deeper integration of environmental values in school practices.

Figure 3 highlights the key stakeholders supporting school environmental programs, each playing a unique role in fostering sustainability. The principal leads by creating policies and engaging the school community, while teachers integrate eco-friendly practices into daily lessons despite challenges. School management allocates budgets and provides the necessary infrastructure, supporting effective policy implementation. Students actively participate in projects like recycling and embodying sustainable values in daily life. Parents and school committees contribute through participation and donations, while governments offer policy and financial support via initiatives like Green School. NGOs and environmental agencies provide training and resources. This collaboration among all stakeholders is essential for the success and sustainability of school environmental programs.



Figure 3.
The main stakeholders involved in supporting environmental programs in schools.

6. Discussion

This study analyzes the role of social leadership, teacher challenges, management support, and collaboration between parties in supporting environmentally friendly school programs. The study results show that the principal's leadership is the primary driver in setting policies and motivating the school community to participate actively. However, teachers face the challenge of high workloads and a lack of training in implementing environmental programs. The support of school management, like providing infrastructure and budget, and at the same time, collaboration between teachers, students, parents, NGOs, and the government proves to be key to the program's sustainability. This discussion will explore and relate the findings to the literature and practical implications for schools.

The triangulation depicted in Figure 1 and the findings summarized in Table 1 confirm that various perspectives and methods support the validity and confidence of the research results. The stakeholder involvement shown in Figure 2 underscores the importance of cooperation and collaboration in supporting environmentally friendly programs in schools. These results align with previous research that emphasizes that strong leadership, management support, and stakeholder collaboration are critical to the success and sustainability of school environmental programs [31].

The findings of this study show that social leadership, especially school principals, plays a key role in creating and implementing a school culture that focuses on environmental sustainability. Proactive and visionary principals implement environmental policies and serve as role models for teachers, students, and the entire school community [32]. They lead the green program through a participatory approach that involves all stakeholders, including teachers, students, parents, and external parties such as NGOs and governments [33]. Strategies implemented include motivating active participation through school environmental projects, integrating sustainability materials into the curriculum, and managing facilities such as recycling and using renewable energy [34]. The support from the principal plays a significant role in encouraging the involvement of all parties, creating a sense of shared responsibility for the school environment program [35].

These findings align with previous research that emphasizes the importance of leadership in driving sustainability in the educational environment. For example, Sweden shows that school principals' participatory leadership can increase environmental awareness among students and staff [36]. Social leadership involving collaboration between teachers, students, and local communities can improve the effectiveness of sustainability programs [37]. This is consistent with the results of this study, which highlights that proactive and collaborative leadership plays a central role in building an environmentally friendly school culture [38]. Strong leadership support directs policy and creates a positive school climate that encourages all stakeholders to participate actively in environmental activities [39].

The findings of this study reveal that teachers face many obstacles in integrating environmentally friendly practices into teaching activities and daily life in schools. The principal challenge teachers face is the high workload, making it difficult to pay more attention to environmental programs [40]. In addition, the lack of specialized training in environmental education hinders teachers' ability to adopt sustainability materials in teaching effectively [41]. Teachers also complained about the limitations of facilities, such as the lack of green areas and recycling sites in schools, which reduce the effectiveness of environmental activities [42]. This condition causes environmentally friendly programs in schools to be inconsistent and difficult to practice sustainably.

These findings align with previous research, which shows that one of the main barriers to environmental education is the lack of training support and resources available to teachers [43]. Another study found that high workloads and a lack of time hinder teachers from integrating environmental programs into teaching [44]. The study confirms that for environmental programs to be better adopted, schools must improve training for teachers, reduce their workload, and provide infrastructure that supports sustainability programs [45]. This support will allow teachers to be more actively involved in environmental education and ensure that eco-friendly programs can be implemented effectively and consistently [46].

This study's findings show that school management's role is crucial in supporting environmental programs through clear policies, resource allocation, and developing environmentally friendly infrastructure. Proactive school management has established policies encouraging reducing plastic use, better waste management, and greening of school areas [47]. In addition, management is responsible for allocating budgets to support environmental activities such as solar panel installation, recycling facilities, and procurement of energy-saving devices [48]. This policy is implemented with a commitment to build infrastructure that supports the implementation of sustainability in a sustainable manner [49]. Financial support and sustainable management policies are essential in implementing environmental programs involving all school residents [50].

These findings are consistent with previous studies that emphasized that the success of environmental programs in schools depends on management support, particularly regarding resource provision and infrastructure development [51]. Previous research also found that schools that provide adequate environmental facilities, such as greening areas and recycling programs, have a higher success rate in implementing sustainability programs [52]. Thus, this study confirms that effective school management, through resource allocation and infrastructure development, is essential to support the success of environmental programs and create an environmentally friendly school culture [53].

The findings of this study show that collaboration between various parties in schools, such as teachers, students, school management, parents, and local communities, is a key factor in addressing sustainability challenges and improving the effectiveness of environmental programs. This collaboration can be seen in various school community initiatives, such as recycling projects, school greening, and cooperation activities [54]. Support from parents and school committees through donations, participation in environmental activities, and awareness campaigns at home and in the surrounding environment also strengthens the ecological programs implemented in schools [55]. The results of this study show that strong collaboration between stakeholders ensures the sustainability of environmental programs, with each party actively contributing, both in the provision of resources and the implementation of activities [56].

These findings are supported by previous research, which asserts that collaboration between the school community and the wider community plays a significant role in the success of sustainability programs [37]. Another study found that environmental programs involving cross-stakeholder collaboration are more successful because a sense of collective responsibility motivates greater participation from all parties [57]. This collaboration also directly impacts the program's sustainability, where the active involvement of the entire school community ensures that the eco-friendly program can run consistently and have a long-term impact on changing school culture [58].

7. Conclusion

The study concludes that proactive and participatory social leadership is important in creating an eco-friendly school culture. The principal acts as a key driver in the involvement of the entire school community in environmental programs. Although teachers face challenges such as high workloads and a lack of specialized training on sustainability, these challenges can be overcome with the support of school management that provides adequate resources and infrastructure. In addition, strong collaboration between teachers, students, parents, and management has proven to be the key to the success and sustainability of environmental programs.

As a recommendation, schools are advised to provide specialized training for teachers in sustainability education to improve their ability to integrate environmental materials into teaching. School management also needs to allocate adequate budgets to support the development of environmentally friendly infrastructure and ensure consistent program implementation. Finally, closer collaboration between schools, parents, and the external community needs to be strengthened to support the success and sustainability of school green programs.

8. Research Limitations

This study has several limitations, including the fact that the sample may not be fully generalizable to schools in other regions and the cross-sectional nature that limits the understanding of the sustainable development of environmental programs. In addition, external factors such as government support and regulations have not been analyzed in depth. There are also limitations in measuring collaboration between parties, which are only based on stakeholder reports, so the potential for bias still exists. Further research is needed to expand the scope of findings and deepen the analysis related to external factors and collaboration dynamics in supporting the sustainability of environmentally friendly programs in schools.

References

- [1] A. Reid, "Climate change education and research: Possibilities and potentials versus problems and perils?," *Environmental Education Research*, vol. 25, no. 6, pp. 767-790, 2019. <https://doi.org/10.1080/13504622.2019.1664075>
- [2] Y. Kim, H.-E. Chu, and G. Lim, *Science curriculum changes and STEM education in East Asia. In Science education in East Asia: Pedagogical innovations and research-informed practices*. Singapore: Springer, 2015.
- [3] Y. N. Adriyanto, D. N. Martono, and T. E. Soesilo, "Environmental awareness at senior high school in Jakarta," in *IOP Conference Series: Earth and Environmental Science*, 2021, vol. 716, no. 1: IOP Publishing, p. 012046.
- [4] R. S. Oktari, K. Shiwaku, K. Munadi, and R. Shaw, "Enhancing community resilience towards disaster: The contributing factors of school-community collaborative network in the tsunami affected area in Aceh," *International Journal of Disaster Risk Reduction*, vol. 29, pp. 3-12, 2018.
- [5] H. Kopnina, *Education for sustainable development (ESD): The turn away from 'environment' in environmental education?* (Environmental and sustainability education policy). London: Routledge, 2018.
- [6] F. B. Piasentin and L. Roberts, "What elements in a sustainability course contribute to paradigm change and action competence? A study at Lincoln University, New Zealand," *Environmental Education Research*, vol. 24, no. 5, pp. 694-715, 2018.
- [7] P. Fuchs *et al.*, "Promoting sustainable development in higher education institutions: The use of the balanced scorecard as a strategic management system in support of green marketing," *International Journal of Sustainability in Higher Education*, vol. 21, no. 7, pp. 1477-1505, 2020. <https://doi.org/10.1108/IJSHE-06-2019-0167>
- [8] L. A. Kensler and C. L. Uline, *Leadership for green schools: Sustainability for our children, our communities, and our planet*. New York: Routledge, 2016.
- [9] U. Fredriksson, K. N. Kusanagi, P. Gougoulakis, Y. Matsuda, and Y. Kitamura, "A comparative study of curriculums for education for sustainable development (ESD) in Sweden and Japan," *Sustainability*, vol. 12, no. 3, p. 1123, 2020. <https://doi.org/10.3390/su12031123>
- [10] U. Fredriksson, K. N. Kusanagi, P. Gougoulakis, Y. Matsuda, and Y. Kitamura, "A comparative study of curriculums for education for sustainable development (ESD) in Sweden and Japan," *Sustainability*, vol. 12, no. 3, p. 1123, 2020. <https://doi.org/10.3390/su12031123>
- [11] P. Vaughter, M. McKenzie, L. Lidstone, and T. Wright, "Campus sustainability governance in Canada: A content analysis of sustainability policies," *International Journal of Sustainability in Higher Education*, vol. 17, no. 5, pp. 611-625, 2016. <https://doi.org/10.1108/IJSHE-06-2015-0100>
- [12] P. Vaughter, M. McKenzie, L. Lidstone, and T. Wright, "Campus sustainability governance in Canada: A content analysis of post-secondary institutions' sustainability policies," *International Journal of Sustainability in Higher Education*, vol. 17, no. 1, pp. 16-39, 2016. <https://doi.org/10.1108/IJSHE-05-2014-0075>
- [13] A. M. Zaliyanti and M. Z. Azani, "Implementation of the Adiwiyata program by the principal to foster students' morals towards the environment," *Journal of Islamic Education*, vol. 9, no. 1, pp. 359-383, 2024. <https://doi.org/10.52615/jie.v9i1.391>
- [14] A. M. Zaliyanti and M. Z. Azani, "Implementation of The Adiwiyata program by the principal to foster students' morals towards the environment," *Journal of Islamic Education*, vol. 9, no. 1, pp. 359-383, 2024. <https://doi.org/10.52615/jie.v9i1.391>
- [15] I. Zikri, "Social transformation and the change of community capacity of Post-Tsunami Aceh, Indonesia," *Pertanika Journal of Social Sciences and Humanities*, vol. 25, no. 3, pp. 1297-1318, 2017.
- [16] S.-S. Yoo and M. Jeon, "New wine needs to be put into new bottles: legitimating education for sustainability in south Korea's higher education institutions," *Journal of Teacher Education for Sustainability*, vol. 24, no. 2, pp. 129-146, 2022.
- [17] L. Li, P. Hallinger, K. J. Kennedy, and A. Walker, "Mediating effects of trust, communication, and collaboration on teacher professional learning in Hong Kong primary schools," *International Journal of Leadership in Education*, vol. 20, no. 6, pp. 697-716, 2017. <https://doi.org/10.1080/13603124.2017.1320811>
- [18] R. Pebriantika, A. Abdurrahman, H. Hariri, and B. Rahman, "Leadership in green school practices: a case study of the principal's roles towards reducing global warming risk in Lampung, Indonesia," in *Journal of Physics: Conference Series*, 2020, vol. 1572, no. 1: IOP Publishing, p. 012042.

- [19] A. M. Corpuz, T. C. San Andres, and J. M. Lagasca, "Integration of environmental education (EE) in teacher education programs: Toward sustainable curriculum greening," *Problems of Education in the 21st Century*, vol. 80, no. 1, p. 119, 2022.
- [20] P. Glavič, "Identifying key issues of education for sustainable development," *Sustainability*, vol. 12, no. 16, p. 6500, 2020. <https://doi.org/10.3390/su12166500>
- [21] A. Asrial, S. Syahrial, D. A. Kurniawan, M. Subandiyo, and N. Amalina, "Exploring obstacles in language learning among prospective primary school teacher," *International Journal of Evaluation and Research in Education*, vol. 8, no. 2, pp. 249-254, 2019. <https://doi.org/10.11591/ijere.v8i2.4281>
- [22] C. P. Lim, Juliana, and M. Liang, "An activity theory approach toward teacher professional development at scale (TPD@ Scale): A case study of a teacher learning center in Indonesia," *Asia Pacific Education Review*, vol. 21, no. 4, pp. 525-538, 2020. <https://doi.org/10.1007/s12564-020-09703-x>
- [23] E. Muafiah, A. Afifah, D. Nurohman, and S. Huda, "The concept of eco-friendly schools: The application of science education in shaping children's characters to the environment," in *Journal of Physics: Conference Series*, 2021, vol. 1796, no. 1: IOP Publishing, p. 012063.
- [24] L. Larri and A. Colliver, "Moving green to mainstream: Schools as models of sustainability for their communities—The Australian Sustainable Schools Initiative (AuSSI)," *Green schools globally: Stories of impact on education for sustainable development*, pp. 61-83, 2020.
- [25] P. Aksorn and C. Charoenngam, "Sustainability factors affecting local infrastructure project: The case of water resource, water supply, and local market projects in Thai communities," *Facilities*, vol. 33, no. 1/2, pp. 119-143, 2015. <https://doi.org/10.1108/F-10-2013-0088>
- [26] A. Bandur, M. Hamsal, and A. Furinto, "21st Century experiences in the development of school-based management policy and practices in Indonesia," *Educational Research for Policy and Practice*, vol. 21, no. 1, pp. 85-107, 2022. <https://doi.org/10.1007/s10671-021-09331-x>
- [27] J. Preston and K. E. Barnes, "Successful leadership in rural schools: Cultivating collaboration," *The Rural Educator*, vol. 38, no. 1, pp. 6-15, 2017. <https://doi.org/10.35608/ruraled.v38i1.231>
- [28] J. Evans, R. Jones, A. Karvonen, L. Millard, and J. Wendler, "Living labs and co-production: University campuses as platforms for sustainability science," *Current Opinion in Environmental Sustainability*, vol. 16, pp. 1-6, 2015. <https://doi.org/10.1016/j.cosust.2015.07.003>
- [29] K. O. Strunk, J. A. Marsh, S. C. Bush-Mecenas, and M. R. Duque, "The best laid plans: An examination of school plan quality and implementation in a school improvement initiative," *Educational Administration Quarterly*, vol. 52, no. 2, pp. 259-309, 2016. <https://doi.org/10.1177/0013161X15616864>
- [30] A. Markarma, J. A. Latif, and A. Adam, "Post Harmony and the Role of the Elites in Reconciliation Based On Restorative Justice in Sigi District (Social Conflict in the Perspective of Islamic Education)," *International Journal of Social Science and Human Research*, vol. 5, no. 10, 2022.
- [31] G. Dyer and M. Dyer, "Strategic leadership for sustainability by higher education: the American College & University Presidents' Climate Commitment," *Journal of Cleaner Production*, vol. 140, pp. 111-116, 2017. <https://doi.org/10.1016/j.jclepro.2016.05.042>
- [32] N. Kholis, N. Mufidah, L. Indriharta, and M. Munardji, "Spirit visionary leadership in developing green school and character," in *Proceedings of 1st Workshop on Environmental Science, Society, and Technology, WESTECH 2018, December 8th, 2018, Medan, Indonesia*, 2019.
- [33] I. Alkaher and D. Gan, "The role of school partnerships in promoting education for sustainability and social capital," *The Journal of Environmental Education*, vol. 51, no. 6, pp. 416-433, 2020. <https://doi.org/10.1080/00958964.2020.1780027>
- [34] A. Altassan, "Sustainable integration of solar energy, behavior change, and recycling practices in educational institutions: a holistic framework for environmental conservation and quality education," *Sustainability*, vol. 15, no. 20, p. 15157, 2023. <https://doi.org/10.3390/su152015157>
- [35] M. Tschannen-Moran and C. R. Gareis, "Faculty trust in the principal: An essential ingredient in high-performing schools," *Journal of Educational Administration*, vol. 53, no. 1, pp. 66-92, 2015. <https://doi.org/10.1108/JEA-02-2014-0024>
- [36] M. Liljenberg, "Distributing leadership to establish developing and learning school organisations in the Swedish context," *Educational Management Administration & Leadership*, vol. 43, no. 1, pp. 152-170, 2015. <https://doi.org/10.1177/1741143213510500>
- [37] T. L. Green, "School as community, community as school: Examining principal leadership for urban school reform and community development," *Education and Urban Society*, vol. 50, no. 2, pp. 111-135, 2018. <https://doi.org/10.1177/0013124517742961>
- [38] G. Kumar, P. Meena, and R. M. Difrancesco, "How do collaborative culture and capability improve sustainability?," *Journal of Cleaner Production*, vol. 291, p. 125824, 2021. <https://doi.org/10.1016/j.jclepro.2021.125824>
- [39] Y. Ni, R. Yan, and D. Pounder, "Collective leadership: Principals' decision influence and the supportive or inhibiting decision influence of other stakeholders," *Educational Administration Quarterly*, vol. 54, no. 2, pp. 216-248, 2018. <https://doi.org/10.1177/0013161X17750706>
- [40] C. Boakye and J. G. Ampiah, "Challenges and solutions: The experiences of newly qualified science teachers," *Sage Open*, vol. 7, no. 2, p. 2158244017706710, 2017. <https://doi.org/10.1177/2158244017706710>
- [41] E. O. Anyolo, S. Kärkkäinen, and T. Keinonen, "Implementing education for sustainable development in Namibia: School teachers' perceptions and teaching practices," *Journal of Teacher Education for Sustainability*, vol. 20, no. 1, pp. 64-81, 2018. <https://doi.org/10.2478/jtes-2018-0005>
- [42] M. Ghosn-Chelala and B. Akar, "Citizenship education for environmental sustainability in Lebanon: public school teachers' understandings and approaches," *Environmental Education Research*, vol. 27, no. 3, pp. 366-381, 2021. <https://doi.org/10.1080/13504622.2021.1879535>
- [43] S.-Y. Liu, S.-C. Yeh, S.-W. Liang, W.-T. Fang, and H.-M. Tsai, "A national investigation of teachers' environmental literacy as a reference for promoting environmental education in Taiwan," *The Journal of Environmental Education*, vol. 46, no. 2, pp. 114-132, 2015. <https://doi.org/10.1080/00958964.2015.1012934>

- [44] M. S.-J. Gregory and J. M. Lodge, "Academic workload: the silent barrier to the implementation of technology-enhanced learning strategies in higher education," *Distance education*, vol. 36, no. 2, pp. 210-230, 2015. <https://doi.org/10.1080/01587919.2015.1051645>
- [45] U. K. Abonyi, R. Yeboah, and A. W. Luguterah, "Exploring work environment factors influencing the application of teacher professional development in Ghanaian basic schools," *Cogent Social Sciences*, vol. 6, no. 1, p. 1778915, 2020. <https://doi.org/10.1080/23311886.2020.1778915>
- [46] M. Hernández-Barco, J. Sánchez-Martín, I. Corbacho-Cuello, and F. Cañada-Cañada, "Emotional performance of a low-cost eco-friendly project based learning methodology for science education: An approach in prospective teachers," *Sustainability*, vol. 13, no. 6, p. 3385, 2021. <https://doi.org/10.3390/su13063385>
- [47] R. Verma and P. Grover, "Role of social media in promotion of green school initiatives by government green schools in India," *Journal of Public Affairs*, vol. 22, no. 4, p. e2643, 2022. <https://doi.org/10.1002/pa.2643>
- [48] K. Anokye, A. S. Mohammed, P. Agyemang, B. A. Agya, E. E. Y. Amuah, and S. Sodoke, "Understanding the perception and awareness of senior high school teachers on the environmental impacts of plastic waste: Implications for sustainable waste education and management," *Social Sciences & Humanities Open*, vol. 10, p. 100999, 2024. <https://doi.org/10.1016/j.ssaho.2024.100999>
- [49] R. Lozano *et al.*, "A review of commitment and implementation of sustainable development in higher education: Results from a worldwide survey," *Journal of Cleaner Production*, vol. 108, pp. 1-18, 2015. <https://doi.org/10.1016/j.jclepro.2015.06.090>
- [50] K. P. Dhakal and L. R. Chevalier, "Managing urban stormwater for urban sustainability: Barriers and policy solutions for green infrastructure application," *Journal of Environmental Management*, vol. 203, pp. 171-181, 2017. <https://doi.org/10.1016/j.jenvman.2017.07.023>
- [51] P. Hutchings *et al.*, "A systematic review of success factors in the community management of rural water supplies over the past 30 years," *Water Policy*, vol. 17, no. 5, pp. 963-983, 2015. <https://doi.org/10.2166/wp.2015.038>
- [52] K. J. Coyle, "Green schools in the United States," *Green schools globally: Stories of impact on education for sustainable development*, pp. 385-401, 2020.
- [53] W. H. Prasetyo *et al.*, "Caring for the environment in an inclusive school: The Adiwiyata green School program in Indonesia," *Issues in Educational Research*, vol. 30, no. 3, pp. 1040-1057, 2020.
- [54] L. Somwaru, "The green school: A sustainable approach towards environmental education: Case study: A cooperation between the suriname conservation foundation (SCF) state oil foundation for community development and the suriname waste management foundation (SUWAMA)," *Brazilian Journal of Science and Technology*, vol. 3, pp. 1-15, 2016. <https://doi.org/10.1186/s40552-016-0023-6>
- [55] B. Chileshe, *Enhancing health campaigns through environmental education: A case of the 'Keep Zambia clean and healthy' programme*. Lusaka: The University of Zambia, 2018.
- [56] J. Goodman, A. Korsunova, and M. Halme, "Our collaborative future: Activities and roles of stakeholders in sustainability-oriented innovation," *Business Strategy and the environment*, vol. 26, no. 6, pp. 731-753, 2017. <https://doi.org/10.1002/bse.1921>
- [57] M. L. Barnett, I. Henriques, and B. W. Husted, *Governing the void between stakeholder management and sustainability* (Sustainability, stakeholder governance, and corporate social responsibility). Bingley, UK: Emerald Publishing Limited, 2018.
- [58] J. Jimlan, "Carbon footprint status, climate change mitigation awareness and education for sustainable development perceptions of school principals in the Island of Panay: bases for an Eco-school toolkit," *Journal of World Englishes and Educational Practices*, vol. 3, no. 1, pp. 23-52, 2020.

Appendix 1.

Questions for In-Depth Interviews and FGDs.

A. The Role of Social Leadership in Encouraging the Development of an Eco-Friendly School Culture

1. How did the principal start an eco-friendly initiative in your school?
2. What strategies are implemented by the principal to involve the entire school community in the environmental program?
3. How does the principal's leadership affect student enthusiasm and participation in environmental activities?
4. What form of concrete support is provided by the principal in the school environment program?
5. How do school principals work together with teachers to formulate environmentally friendly school policies?
6. How do principals integrate sustainability values into the school curriculum?
7. How do principals overcome resistance from teachers or students to environmentally-focused changes?
8. To what extent do school principals encourage cooperation with external organizations such as environmental NGOs?
9. What are the challenges that principals face in leading environmental programs in schools?
10. How do principals ensure the continuity of environmental programs in schools despite changes in leadership or policies?
11. How do principals inspire teachers and students to continue to engage in environmental programs?
12. How do you assess the effectiveness of the principal's leadership in implementing an eco-friendly school culture?

B. Challenges Faced by Teachers in Adopting and Implementing Eco-Friendly Programs

1. What are your biggest challenges when integrating environmental programs into everyday teaching?
2. How difficult is it to combine eco-friendly materials with a standard curriculum?
3. How is your workload affected by additional responsibilities related to environmental programs?
4. What are the main obstacles you face when it comes to sustainability and environmental education training?
5. How do students react to the eco-friendly programs you teach?
6. Do school facilities support environmental programs? If not, what is needed?
7. How do school policies affect your ability to implement environmental programs?
8. How much support do you receive from principals regarding environmental programs?

9. How are parents responding to the environmental programs you run?
10. What additional resources are needed to improve the effectiveness of environment-related teaching?
11. How do you deal with resistance from students or parents to environmental programs?
12. What can be done to reduce teachers' challenges in implementing environmental programs?
- C. The Role of School Management in Supporting the Transformation of Education Oriented to Environmental Sustainability
 1. How do school management policies support the implementation of environmental programs?
 2. Does the school management allocate a specific budget for environmental programs? How is the allocation used?
 3. How does management ensure facilities support green initiatives like recycling systems or renewable energy?
 4. To what extent is school management involved in formulating school environment strategies?
 5. How does management work with teachers to implement sustainability policies?
 6. What form of concrete support management for environmental programs is provided to teachers?
 7. How does management overcome resource limitations in supporting the transformation of environmentally friendly education?
 8. How does management collaborate with external parties, such as governments or environmental organizations, to support school programs?
 9. What are the main challenges faced by management in ensuring the sustainability of environmentally friendly programs?
 10. How does management assess the success of the environmental programs that have been implemented?
 11. Are there any initiatives from school management to provide training or professional development to teachers related to sustainability?
 12. How does the management ensure that the environmental program in the school runs sustainably and long-term?
- D. Collaboration Between Teachers, Students, and Management in Improving the Effectiveness of Environmentally Friendly Programs
 1. How do you (teachers, students, management) collaborate in running school environmental programs?
 2. How big is the role of students in implementing environmentally friendly programs in schools?
 3. How do teachers and management work together in planning school environment programs?
 4. How are parents or school committees involved in neighborhood programs?
 5. What is the most effective collaboration between teachers and students in implementing environmental programs?
 6. How do you assess the level of student engagement in an environmental program?
 7. What is the role of school management in encouraging collaboration between students and teachers regarding environmental activities?
 8. How do eco-friendly activities in schools affect the relationship between students and teachers?
 9. What are the biggest challenges faced in building collaboration between parties in implementing environmental programs?
 10. How do schools measure the success of collaboration between parties in environmental programs?
 11. To what extent are students free to design and execute environmental projects in schools?
 12. How does collaboration between teachers, students, and management improve the success of school environmental programs?

Appendix 2.

Questions and Statements for Field Observations and Documentation.

A. *The Role of Social Leadership in Encouraging the Development of an Eco-Friendly School Culture*

Sub-Questions for Observation:

1. How do principals interact with teachers and students in environmentally friendly activities at school?
2. Are the principals seen leading or present in environmental programs such as greening or recycling?
3. Are there any formal meetings or meetings that discuss eco-friendly policies or initiatives in schools?
4. How do principals communicate the environmental vision to the school community?
5. Does the principal involve parents in the neighborhood program?
6. How is the principal's leadership reflected in student involvement in eco-friendly activities?
7. Does the principal award or recognize students and teachers who contribute to environmental programs?
8. To what extent are school principals directly involved in monitoring the implementation of environmental programs in schools?
9. Does the principal provide training or seminars to teachers and students related to the environment?
10. Is the environmental policy written and in an easily accessible place in the school?
11. How do principals encourage a culture of sustainability in other aspects of the school, such as energy consumption?
12. Does the principal actively work with NGOs or external agencies related to environmental programs?

Statement for Documentation:

1. The documentation of school policies or regulations related to eco-friendly programs.
2. Report on the principal's activities related to the environmental program.
3. Minutes of school meetings related to environmental initiatives.
4. The principal delivers socialization materials or announcements related to environmental programs.

5. Certificates or awards are given to parties involved in environmental activities.

A. *Challenges Faced by Teachers in Adopting and Implementing Eco-Friendly Programs*

Sub-Questions for Observation:

1. How do teachers interact with students when teaching eco-friendly programs in the classroom?
2. Do teachers seem to have difficulty in managing time for environmentally friendly activities?
3. To what extent are supporting facilities (such as green spaces and recycling bins) available in schools?
4. How do teachers use existing resources to teach environmental materials?
5. Are there any environmental activities running without adequate school infrastructure support?
6. How do students respond to teacher-led environmental activities?
7. Do teachers seem to be active in developing environmental programs with other schools?
8. How do teachers handle resource or time constraints when carrying out environmental activities?
9. Do teachers receive training or information related to sustainability and environmental education?
10. Do teachers integrate environmental topics into classroom instruction?
11. Are teachers involved in environmental activities outside of school hours, such as during recess or after school hours?
12. How do teachers use teaching aids such as posters or digital materials to teach the environment?

Statement for Documentation:

1. A curriculum document that integrates environmental education.
2. Training reports or seminars attended by teachers related to environmental programs.
3. Teachers' reports related to the challenges faced in teaching ecological topics.
4. Schedule and lesson modules that include eco-friendly materials.
5. Evaluation of programs or surveys conducted related to the success or constraints of school environmental programs.

B. *The Role of School Management in Supporting the Transformation of Education Oriented to Environmental Sustainability*

Sub-Questions for Observation:

1. How does school management allocate space for environmental programs, such as recycling sites or green areas?
2. Are any physical facilities, such as solar panels, demonstrating management's sustainability support?
3. How does management interact with teachers and students in support of environmental initiatives?
4. Are there any management meetings or announcements that discuss the sustainability program?
5. How does school management support the procurement of facilities such as recycling tools and environmental teaching materials?
6. Are there facilities that support the use of renewable energy or waste management?
7. To what extent does school management provide resources for environmental activities?
8. How does school management coordinate with outside parties, such as the government or NGOs, to support environmental programs?
9. Are there any bulletin boards or special spaces in the school that promote eco-friendly programs?
10. How does school management allocate budgets for sustainability projects in schools?
11. Are there any dedicated staff assigned to monitor the implementation of the green program?
12. How does school management ensure a sustainable environmental program in the long term?

Statement for Documentation:

1. School budget reports related to environmental programs.
2. Written policy of school management regarding the transformation of environment-based education.
3. Documentation of meetings or correspondence with external parties related to environmental programs.
4. Reports on using facilities like solar panels, recycling systems, or other green infrastructure.
5. Official announcement from management regarding the implementation of environmental programs.

C. *Collaboration Between Teachers, Students, and Management in Improving the Effectiveness of Environmentally Friendly Programs*

Sub-Questions for Observation:

1. How is the interaction between teachers, students, and management in the day-to-day program environment?
2. Is there any cooperation between teachers and students in recycling or reforestation activities?
3. How is management directly involved in supporting collaboration between students and teachers?
4. How do students contribute to decision-making related to environmental activities?
5. Are there forums or meetings between teachers, students, and management to discuss environmental programs?
6. How often do students and teachers work together on neighborhood projects?
7. Is there any collaboration in maintaining environmental facilities such as school parks or recycling sites?
8. How does management facilitate collaborative activities outside the classroom, such as environmental programs during holidays or weekends?
9. Are students allowed to lead environmental initiatives at school?
10. How do teachers involve students in the planning and implementation of environmental activities?

11. How much do students participate in school environmental activities, such as greening or waste management?
12. Are there any events or programs that involve the entire school community to celebrate or support environmental activities?

Statement for Documentation:

1. Reports of collaboration or joint activities between teachers, students, and management in environmental programs.
2. Documents related to student involvement in sustainability-related decision-making programs.
3. The evaluation results or report on the collaboration success between various parties in the environmental program.
4. Announcements or posters that inform about collaborative projects involving students, teachers, and management.
5. A schedule or meeting that indicates a collaborative forum between parties to discuss or develop environmental initiatives.