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Analysis of the Implementation of Education for Sustainable Development (ESD) Values

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Abstract: Education plays a crucial role in supporting the achievement of the SDGs, especially through the integration of ESD principles in the learning process. This study aims to analyze the implementation of ESD values in environmental aspects at Kalirejo 1 Junior High School, which is a provincial Adiwiyata school. This research uses a qualitative approach, collecting data through interviews, observations, questionnaires, and documentation. Data analysis techniques used in this research are data reduction, data presentation, and conclusion drawing. Informants in this study included the principal, vice principal for curriculum, science teachers who were also Adiwiyata team leaders, and student representatives from nine extracurricular activities (two students per extracurricular activity). This study evaluated 99 ESD indicators in the environmental aspect, and the results showed that 94 indicators (95%) had been successfully implemented, which include natural resources, climate change, rural development, sustainable urbanization, and disaster prevention and mitigation. These practices have been integrated into the *Merdeka Curriculum*, both through learning activities and school culture that builds environmental awareness. However, there are still some challenges, namely the non-optimal drainage system and water conservation facilities, such as biopores. This shows that Kalirejo 1 Junior High School has a strong commitment to implementing sustainable education. However, there is still room for improvement so that the implementation of ESD at 1 Kalirejo Junior High School can run more thoroughly, effectively, and sustainably in the future.

Keywords: Adiwiyata School; Education for Sustainable Development (ESD); *Merdeka Curriculum*.

Introduction

Education plays an important role in equipping students with the knowledge and skills to deal with global sustainability issues[1]. Schools play a crucial role in achieving sustainable development goals because they can help children form the character and skills needed to face future challenges [2]. The results of the 2022 PISA Survey show that Indonesia is ranked 63rd out of 81 countries, and when compared to other ASEAN countries such as Singapore, which is ranked 1st, there is a significant gap in the quality of education [3].

This education problem has led the Indonesian government to make various transformation efforts in the education sector, one of which is through the implementation of the *Merdeka Curriculum*. This curriculum is an update of the previous curriculum, which emphasizes learner-centered learning, differentiation, and strengthening character through the Pancasila Student Profile. This curriculum aims to create meaningful and effective learning by fostering faith, piety, noble character, and developing the creative potential, taste, and spirit of students as lifelong learners with Pancasila character [4]. In addition, *Merdeka Curriculum* provides flexibility for schools and teachers to develop contextualised learning materials and approaches according to the needs and environment of students.

Hopefully, this policy will be able to create an educational ecosystem that is more relevant and adaptive to the times. In line with these efforts, the Sustainable Development Goals (SDGs) program is used to improve the quality of education, especially in Indonesia [5]. UNESCO, as a specialized agency under the United Nations in the field of education, is mandated to lead and coordinate the 2030 Education Agenda, which is part of the global effort to realize the 17 Goals of the SDGs, focusing on education as the key to achieving all these goals, especially through the 4th goal, namely Education for Sustainable Development (ESD) which aims to ensure quality education that is inclusive, equitable, and supports lifelong learning for all people [6]. ESD encompasses three main pillars: socio-cultural, environmental and economic [7]. One of the steps taken by the Indonesian government to support the achievement of ESD goals is through the development of the Adiwiyata Program as stipulated in the Regulation of the Minister of Environment and Forestry of the Republic of Indonesia No. 52 of 2019 concerning Environmental Care and Culture Movement in Schools [8]. Referring to the Ministerial Regulation, schools that successfully implement the Care and Culture Movement in Schools (PBLHS) are entitled to receive Adiwiyata awards from the government, regional governments, and district/city governments.

The implementation of ESD in Indonesia, including in Central Lampung District, is a strategic step in supporting government policies, such as the Adiwiyata School program, and global sustainable development goals. Central Lampung Regency itself is an area that is classified as vulnerable to natural disasters. This is in accordance with the Indonesian Disaster Prone Index (IRBI) data, released by BNPB in 2023, of 113.24, which shows that Central Lampung Regency is in

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the disaster-prone category with moderate risk [9]. Therefore, the application of ESD becomes increasingly relevant to build community awareness and preparedness from an early age.

This research was conducted at 1 Kalirejo Junior High School, the selection of this school is based on characteristics that are relevant to the focus of the research, namely, as the only Junior High School in Central Lampung Regency, which is designated as an Adiwiyata School at the Provincial level. The determination is contained in Lampung Governor Decree Number 343 of 2023 concerning the Determination of Adiwiyata Schools in Lampung Province in 2023 [10]. This status shows that 1 Kalirejo Junior High School has met various criteria and indicators in realizing a school that cares and has an environmental culture.

The novelty of this research lies in the analysis of the integration of ESD values within the framework of the *Merdeka Curriculum* and its actual implementation in rural schools located in disaster-prone areas. Previous studies have generally been limited to the implementation of ESD in Adiwiyata schools without explicitly addressing its connection to the *Merdeka Curriculum* and the context of regional vulnerability [11], [15]. Therefore, this study contributes new insights by examining the integration of curriculum, environmental practices, and disaster preparedness in a comprehensive study.

The purpose of this study is to analyze how ESD values are implemented in the environmental aspect of 1 Kalirejo Junior High School. The focus of the research is deliberately directed at the environmental aspect because this part is the most prominent and relevant element in the implementation of the Adiwiyata School program. In the context of ESD, the environmental aspect includes various important things such as natural resource management, climate change, rural development, sustainable urbanization, and disaster prevention and mitigation efforts [7]. The application of ESD values is also in line with the implementation of the *Merdeka Curriculum*, especially through the preparation of the Learning Pathway, which allows the integration of environmental issues into learning. This research is expected to provide a real picture of the practice of sustainable education at the junior high school level, especially in areas that are vulnerable to environmental challenges, such as Central Lampung District.

Research Methods

This study uses a descriptive qualitative approach with a case study design, with the aim of obtaining an overview of the implementation of ESD values in environmental aspects 1 Kalirejo Junior High School. The case study design was chosen because it allows researchers to examine phenomena comprehensively in a real-life context, particularly in a specific location or unit. This study adopts a constructivist paradigm, aiming to understand the subjective meanings and experiences of stakeholders in the implementation of ESD values [12].

Data collection techniques in this study were carried out through several methods. First, interviews were conducted with the school principal, the vice principal for curriculum, the science teacher who is also the head of the Adiwiyata team, and student representatives from nine extracurricular activities (each represented by two students). Thus, the total number of respondents in this study was 21 people, consisting of 3 educators and 18 students. Second, open-ended questionnaires were distributed to the same informants to complement the interviews and gather additional written insights. Third, direct observation was conducted to see the real activities in the school environment, both in the form of routine activities, learning processes that integrate ESD values, as well as facilities and infrastructure that support the implementation of ESD. Fourth, documentation was collected in the form of photos of activities, learning tools, and other supporting documents related to the implementation of ESD at school.

The data analysis technique used in this research involves several stages, namely data reduction, data presentation, and conclusion drawing. In the first stage, data reduction, researchers selected and filtered relevant information from various data sources collected, such as interviews, observations, questionnaires, and documentation. The data that has been filtered and simplified is then presented in the form of bar charts, which aim to facilitate understanding and further analysis. Finally, conclusion drawing is done gradually by linking findings from various data sources to get a comprehensive picture of how ESD values in environmental aspects are implemented at 1 Kalirejo Junior High School.

Results and Discussion

The *Merdeka Curriculum* and the Adiwiyata School program are interconnected and in line with ESD principles, especially in encouraging the application of sustainability values through educational practices and environmental activities involving all school members [13]. ESD is a very relevant approach to the *Merdeka Curriculum* because both emphasize the development of the character of students who think critically, creatively, and are responsible for the environment and the sustainability of life [15]. In the same context, the Adiwiyata program aims to build awareness and active involvement of all school members in preserving and managing the environment through the implementation of effective school governance, in order to create a school culture that supports sustainability [13]. To assess the extent to which ESD principles have been implemented at 1 Kalirejo Junior High School, observations were made on five main aspects of ESD, namely: natural resources, climate change, rural development, sustainable urbanization, and disaster prevention and management.

Table 1 shows the relationship between *Merdeka Curriculum* Learning Outcomes, ESD perspectives, and Adiwiyata School Program indicators. With this mapping, it is hoped that a more complete picture can be obtained of the extent to which the school has integrated sustainability values in its learning process while supporting the achievement of sustainable development goals in the school environment.

The implementation of ESD values in the *Merdeka Curriculum* and the Adiwiyata School Program is reflected in the alignment between learning outcomes and indicators of environmental activities. Figure 1 shows the total number of aspects that have been implemented at Kalirejo 1 Junior High School, which will provide an overview of the level of success of ESD implementation in the context of the *Merdeka Curriculum* and the Adiwiyata School Program.

Table 1. Implementation of ESD Aspects in *Merdeka Curriculum* and Adiwiyata School Program at 1 Kalirejo Junior High School.

ESD Aspects	Learning Outcomes	Adiwiyata Indicators
Natural Resources	Interaction between living things and their environment Recognize the physical and chemical properties of soil	Planting, maintenance, tree/plant nursery School community participation Water conservation Energy conservation
Climate Change	Designing efforts to prevent and address climate change	Planting, maintenance tree/plant nursery School community participation PBLHS campaign Energy conservation
Rural Development	Application of biotechnology	PRLH action for the surrounding community Innovative work of students/teachers Participation in waste removal (waste bank, compostin)
Sustainable Urbanization	Design efforts to prevent and overcome pollution	3R waste management Participation in waste transfer (waste bank composting) Waste management in the environment around the School. Drainage and sanitation cleanliness Student participation in cleaning activities, sanitation and drainage functions of the School. Water conservation Energy conservation
Disaster Prevention and Management	Earth's layer structure and disaster mitigation	Planting, maintenance tree/plant nursery School community participation 3R waste management Drainage and sanitation cleanliness School environment waste management

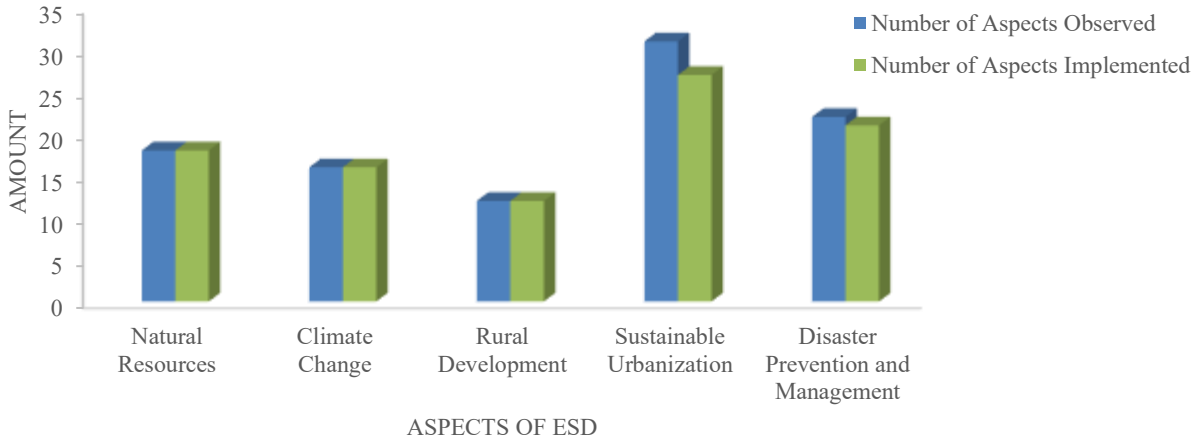

Figure 1. Results Graph of ESD Implementation

Based on the results of data analysis, it is evident that a total of 94 out of 99 (95%) indicators related to the environmental aspect of ESD have been successfully implemented in this school. More detailed data shows that the Natural Resources aspect (18 out of 18), Climate Change (16 out of 16), and Rural Development (12 out of 12) have been fully realised. Meanwhile, in the Sustainable Urbanisation aspect (27 out of 31) and the Disaster Prevention and Mitigation aspect (21 out of 22), indicators have also been successfully implemented. This suggests that most of the ESD values have been effectively put into practice, although some areas still require improvement.

In the implementation of ESD values in the *Merdeka Curriculum*, all aspects of learning have thoroughly integrated the principles of sustainability. Table 2 presents a mapping between the Learning Outcomes in the *Merdeka Curriculum* related to ESD values that have been implemented in the Science Learning Pathway at Kalirejo 1 Junior High School. This mapping shows the extent to which ESD values have been integrated in learning, while reflecting the school's efforts to realize sustainability-oriented education.

Table 2. Implementation of ESD Aspects in the *Merdeka Curriculum*.

Learning Outcomes	Appropriate Learning Pathway
Interaction between living things and their environment Recognize the physical and chemical properties of soil	7.11 Learners are able to identify the interaction between living things and the environment. 7.29 Learners recognize physical and chemical properties and their relationship with organisms and environmental conservation.
Designing efforts to prevent and address climate change	7.13 Learners are able to design efforts to prevent and overcome pollution.
Application of biotechnology	7.15 Learners are able to apply biotechnology in everyday life.
Design efforts to prevent and overcome pollution	7.12 Learners are able to design efforts to prevent and overcome pollution.
Earth's layer structure and disaster mitigation	7.12 Learners are able to design efforts to prevent and overcome pollution.

From the table, it can be seen that in the aspect of natural resources, ESD values have been integrated in Learning Pathway 7.11, Students are able to identify the interaction of living things and the environment and Learning Pathway 7.29, Students recognise physical and chemical properties and their relationship with organisms and environmental conservation. This is in line with the findings of [15], which shows that by implementing strategies to maintain the character of environmental care, student character building becomes easier, one of which is through consistency in familiarising and implementing school culture.

Furthermore, in the aspect of climate change, students are given an understanding of efforts to prevent and overcome the effects of climate change through material on pollution, especially air pollution caused by greenhouse gas emissions, which can be seen in Learning Pathway 7.13. Learners are able to design efforts to prevent and overcome pollution. This can strengthen students' understanding of sustainability issues that encourage them to think critically in analyzing the causes, impacts, and solutions of the problems faced, as well as train them to not only understand the material conceptually but also make the right decisions and act responsibly towards the environment [16].

Then for the Rural Development aspect, students are introduced to the concept of biotechnology through science material, which is related to environmental management. The material is found in Learning Pathway 7.15. Students are able to apply biotechnology in everyday life. The integration of environmental care education in science learning can increase students' awareness and responsibility for the surrounding environment [17].

Furthermore, material about sustainable urbanization has been inserted in science lessons, namely in Learning Pathway 7.12. Students are able to design efforts to prevent and overcome pollution. This can provide students with an understanding that environmentally sound urbanization is important because it prioritizes the efficient use of natural resources and environmental protection, but although it aims to support sustainable development, the process can also cause pollution and damage to ecosystems, so it is important for students to understand the environmental impacts that are often ignored [18].

Then, in disaster prevention and mitigation efforts in the school environment, in Learning Pathway 7.27, students understand the structure of the Earth's layers to explain natural phenomena that occur in the context of disaster mitigation. This is important because it can support students' understanding of disaster characteristics, various indicators of disaster occurrence, disaster-prone areas, and mitigation measures that can be taken, so that they have preparedness and comprehensive knowledge in dealing with potential disasters in the surrounding environment [19].

In addition, in the context of ESD implementation through the Adiwiyata School program, in the aspect of natural resource management, a program of planting, maintaining, and nursery of trees and plants is carried out. As seen in Figure 2, this school routinely plants vegetables in the classroom garden. Through the theme of sustainable living in the P5 program, students are directly involved in planting activities, especially vegetables that are adapted to the ongoing season. All school members actively participate in preserving the environment. This activity is very useful in supporting sustainability, in line with the findings of [20], which show that school gardens have the potential to be a source of learning about plant classification, plant structure and function.

Figure 2. Classroom Garden

As a tangible manifestation of this responsibility, every month on Friday of the 4th week, Kalirejo 1 Junior High School organizes the Clean, Healthy and Tidy

Movement (Gema Berseri). This activity includes greening through planting trees, flowers, and vegetables, cleaning the school area, pruning plants, and waste management. This is in line with the findings of [14] which shows that through consistent efforts, schools familiarize students to care for the environment and make it part of their daily culture. From these small habits, the character of caring for the environment grows and develops naturally. Furthermore, the climate change aspect shows that the school has made various concrete efforts to support the prevention of climate change. All school members consistently turn off lights, fans, and other electronic devices when not in use, including when leaving school. Not only that, there are posters on the classroom walls such as "Save Energy, Turn Off the Lights!" as part of the PBLHS campaign. According to [21] the habit of turning off electrical appliances when not in use is one of the simple forms of energy-saving cultural education, which has proven effective in shaping caring and energy-aware behavior in the school environment.

Figure 3. Energy Saving Poster

Then, for the Rural Development aspect, the school has shown a real commitment to supporting environmental programs by involving various parties, both within the school and the surrounding community. One of the steps taken is to involve student guardians through the class association, where they are invited to participate in socialization about the environment. Students are also actively involved in various environmental innovations, such as ecobricking and composting. Each class has its own role, with grades 7 and 8 responsible for sorting organic waste into compost, as shown in Figure 4 and inorganic waste into ecobricks, as shown in Figure 5, while grade 9 focuses on making ecobricks into chairs. Waste management into ecobricks and compost can foster the character of environmental care in students through simple habits that are done consistently, in which, in the process, students learn to dispose of waste in its place, sort organic and inorganic waste, and maintain personal hygiene, such as washing hands after activities [22].

Figure 4. Composting Activity

Furthermore, Kalirejo 1 Junior High School has made various efforts in supporting sustainable urbanization. In an effort to reduce waste, the school applies the 3R principle (Reduce, Reuse, Recycle) by encouraging simple habits such as bringing their own lunches and drinking bottles from home. Each class is also provided with gallons of drinking water, so students do not need to buy bottled drinks that produce plastic waste. This step is part of the strategy to minimize the adverse impact of plastic waste, which includes increasing recycling efficiency, limiting the use of single-use plastics, education, and supporting policies that support sustainable waste management [23]. For its own waste management, the school has provided segregated bins for organic and inorganic waste. Organic waste such as food waste is processed into compost, while inorganic waste, especially plastic, is used to make ecobricks.

Figure 5. Ecobricking Activity

As an effort to save water, the school has put up posters such as "Use Water Sparingly" and "Save Water Save the Earth", as shown in Figure 6. In addition, large faucets are only opened at certain times, such as during prayer, so that water is not wasted. This is in line with the opinion of [24], which states that one of the solutions to overcome the crisis and environmental damage is to increase the efficiency of water use, which can reduce the waste of natural resources and support environmental sustainability.

Figure 6. Water Saving Poster

However, the school still does not have water conservation facilities such as biopore infiltration pits, so rainwater management and water infiltration into the ground cannot be fully maximized. In addition, the school's drainage system is not yet optimal. Some drains often experience blockages, mainly due to the habit of throwing garbage in the gutter. This causes puddles of water when it rains, as there are no adequate drains available. This is certainly an important homework for the school to immediately improve the drainage system so that the water flow is smooth and does not cause puddles. To overcome this problem, one solution that can be considered is the implementation of a drainage

system with the concept of eco-drainage, such as the use of infiltration ponds, which have been proven effective in minimizing surface runoff [25].

These challenges can be used as opportunities for contextual learning for students. For example, drainage problems can be used as topics in problem-based learning (PBL) projects that train students to think critically, work together in teams, and design real solutions for improving the school environment. This is in line with the spirit of the *Merdeka Curriculum* and the strengthening of the Pancasila Student Profile.

Additionally, 1 Kalirejo's Junior High School experience in integrating ESD values, though not yet perfect, can serve as a foundation for developing more sustainable school policies. The good practices that have been implemented have the potential to be replicated in other schools, especially those with similar characteristics. Local governments or education departments can also support this by creating ESD-based mentoring and empowerment programs to ensure more equitable and impactful implementation on the ground.

Figure 7. Interview Process with Some Students

Furthermore, as part of disaster prevention and mitigation efforts in the school environment, interviews with the Vice Principal for Curriculum and several students, as shown in Figure 7, revealed that the school consistently conducts disaster management simulations, such as floods and earthquakes, as part of the disaster mitigation program. This enables students to understand and practice firsthand the evacuation procedures and safety measures to be taken in emergency situations. This is in line with the findings of [26], which states that this training is very important because it helps students to be calm and act safely when a disaster occurs, while shaping their preparedness through a good understanding of mitigation, so that students become more responsive in dealing with emergency situations

Conclusion

Based on the research conducted, it can be concluded that Kalirejo 1 Junior High School has successfully integrated the principles of Education for Sustainable Development (ESD) into the implementation of the Merdeka Curriculum and the Adiwiyata School Program. Out of 99 ESD indicators in the environmental aspect, 94 indicators (95%) have been successfully implemented. This reflects the high commitment of the school in creating a sustainable learning environment, both through learning activities and the active participation of all school members in preserving the environment. Various good practices such as planting plants, 3R waste management, energy and water saving, community involvement in environmental programs, and school preparedness in disaster prevention and mitigation. Nevertheless, there are still some indicators that have not been fully implemented, such as the lack of water conservation facilities and an unoptimized drainage system, which shows that there is still room for improvement so that the implementation of ESD can run more thoroughly and sustainably in the future. Implicitly, the integration of ESD into learning not only strengthens environmental awareness but also enhances students' competencies in critical thinking, creativity, and responsibility toward sustainability issues. This contributes to strengthening the profile of Pancasila Students as the primary objective of the *Merdeka Curriculum*. Therefore, it is recommended that similar policies be expanded to other schools, particularly in disaster-prone areas or those with strategic environmental potential. The best practices implemented at Kalirejo 1 Junior High School can be replicated as a model for ESD implementation based on curriculum and school culture that is contextually relevant.

Author's Contribution

Salma Shafi Safira: contributed to the conceptual framework, literature review, data collection, and drafting the manuscript. Eko Kuswanto: responsible for the formulation of research methodology and data analysis. Anisa Oktina Sari Pratama: data interpretation, discussion of findings, and the final editing of the manuscript.

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