



# Implementation of Environmentally Based Citizenship Education in Increasing Waste Management Awareness in Students

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**ABSTRACT:** Waste management was a growing environmental challenge that required the development of public awareness from an early age. Schools played a strategic role in fostering such awareness through the learning process, including Civics Education (PKn), which integrated environmental values. This study aimed to analyze the implementation of environment-based civics education in increasing students' waste management awareness. A systematic literature review was employed by examining relevant scientific articles on civics education, ecological citizenship, environmental education, and waste management published between 2015 and 2025. Data were collected from Google Scholar, ScienceDirect, SpringerLink, and Garuda, and were analyzed using content analysis techniques to identify key concepts, learning approaches, and major findings. The review indicated that environment-based civics education improved students' waste management awareness by strengthening social responsibility, promoting ecological citizenship, and encouraging practice-based learning such as 5R-based activities (Reduce, Reuse, Recycle, Replace, and Replant). However, its implementation remained constrained by limited curriculum integration, insufficient school facilities, and inadequate teacher competence in integrating environmental values into learning. Therefore, strengthening the integration of environmental education into civics education was essential to develop students' ecological awareness more effectively.

**KEYWORDS:** Citizenship education; environmental education; ecological citizenship; environmental awareness; waste management

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## 1. Introduction

Environmental issues were becoming increasingly complex global challenges and required serious attention from various parties, including educational institutions. Increased human activity, population growth, and changes in consumption patterns led to increased waste and litter, which contributed to environmental pollution and degraded ecosystem quality [1, 2]. These problems were not only related to the technical aspects of waste management but also to human behavior and low public awareness of the importance of environmental preservation [3, 4]. Therefore, systematic efforts were needed to raise public environmental awareness through

educational approaches oriented toward the formation of environmentally friendly values and behaviors.

Education played a crucial role in fostering environmental awareness and pro-environmental behavior among the younger generation. The integration of environmental education into the learning process helped students understand the relationship between human activities and environmental sustainability, thereby encouraging responsible attitudes and behaviors toward the environment [5, 6]. Through the educational process, students not only gained knowledge about environmental issues but also developed critical thinking skills and moral awareness, which encouraged them to participate in environmental preservation [7]. Thus, education served as a strategic tool in developing a generation with ecological awareness and an active role in maintaining environmental sustainability.

One subject with significant potential for fostering environmental awareness was Civics Education (PKn). Civics education not only taught the concepts of citizens' rights and obligations in political and social life but also instilled values of social responsibility and concern for various public issues, including environmental issues [8, 9]. From the perspective of modern civics education, environmental awareness was viewed as part of citizens' responsibilities in maintaining the sustainability of shared life. This concept was known as ecological citizenship, which emphasized individual moral responsibility for environmental sustainability and active participation in maintaining ecosystem balance [10, 11]. The concept of ecological citizenship positioned individuals as key actors in environmental protection through daily actions such as waste reduction, responsible resource use, and participation in environmental conservation activities. The integration of environmental values into civics learning also aligned with the concept of Education for Sustainable Development (ESD), which emphasized the importance of education in developing ecological awareness, critical thinking skills, and social responsibility toward the environment [6, 12, 13]. Sustainability-oriented education aimed not only to increase students' environmental knowledge but also to foster environmentally friendly behaviors applicable in everyday life [5]. Through this approach, civics learning became a strategic tool for building students' ecological awareness and encouraging active participation in environmental preservation efforts.

One of the most significant environmental issues in everyday life was waste management. The increase in waste without effective management systems led to various negative impacts, such as soil, water, and air pollution, as well as declining public health [1, 2]. Waste problems occurred not only in the community but also in schools, which should have served as environments for fostering students' environmental awareness. Various studies showed that students' awareness of waste management remained relatively low, as indicated by littering behavior and limited participation in environmental management activities at school [14, 15]. Several studies demonstrated that integrating environmental education into civics learning increased students' ecological awareness. Research by Yusuf et al. [14] showed that the concept of environmental citizenship had a positive relationship with students' environmental behavior in Adiwiyata schools. Students with a strong understanding of environmental citizenship tended to exhibit more positive behavior in maintaining a clean school environment. Other studies indicated that civics education integrating environmental values shaped environmentally conscious character through the development of civic knowledge, civic skills, and civic dispositions related to environmental issues [16].

Furthermore, the implementation of waste management based on the 5R principles (Reduce, Reuse, Recycle, Replace, and Replant) in civics learning was shown to increase students' awareness of the importance of responsible waste management in the school environment [17]. This education-based waste management program not only increased students' knowledge but also fostered environmentally responsible attitudes and behaviors through hands-on activities that directly involved students. Other research showed that civics education integrating the concept of ecological citizenship shaped students' environmental awareness and encouraged active participation in conservation activities supporting the Sustainable Development Goals (SDGs) [10]. However, in practice, civics education in schools still tended to emphasize cognitive aspects and memorization of concepts without being accompanied by concrete implementation in daily life. As a result, students understood civics concepts theoretically but did not consistently develop attitudes and behaviors that supported environmental conservation [8, 9]. Furthermore, the implementation of environmentally based civics education in schools remained limited and was not systematically integrated into the learning process. This situation indicated a gap between the ideal concept of environmentally based civics education and its actual implementation.

Although various studies have examined environmental education in schools, most focused on science subjects or the Adiwiyata school program. Research specifically examining the integration of ecological citizenship concepts into civics education to increase students' awareness of waste management remained relatively limited. In fact, civics education had significant potential to foster social responsibility and environmental awareness as part of sustainable citizenship. Based on these issues, more in-depth research was needed to examine how the implementation of environmentally based civics education could increase students' awareness of waste management in the school environment. This study was expected to contribute to the development of more contextual and applicable civics education and to shape students' ecological character through waste management practices in the school environment.

## **2. Materials and Methods**

### *2.1. Search strategy.*

This study used a systematic literature review approach to analyze the implementation of environment-based citizenship education in increasing students' waste management awareness. A systematic literature review was selected because it provided a structured, transparent, and reproducible approach for synthesizing evidence from previous studies relevant to the research objectives. The literature review method was used to examine, analyze, and synthesize various prior studies relevant to the research topic in order to gain a comprehensive understanding of the concept and practice of environment-based citizenship education [18]. This approach also allowed for the identification of research gaps and trends in the field of environmental education and civic learning [19].

A systematic search was conducted using several academic databases, including Google Scholar, ScienceDirect, SpringerLink, and Garuda, to ensure comprehensive coverage of both national and international publications. The search used combinations of keywords such as "civic education," "environmental citizenship," "environmental awareness," "environmental education," and "waste management education," combined with Boolean operators (AND, OR) to refine and expand the search results. The search process was limited to articles published

between 2015 and 2025 to ensure the relevance and recency of the literature. Additionally, backward and forward citation tracking was conducted to identify other relevant studies that might not have been captured in the initial database search.

## *2.2. Inclusion and exclusion criteria.*

To ensure the quality, relevance, and consistency of the selected studies, inclusion and exclusion criteria were applied systematically. The inclusion criteria included peer-reviewed journal articles that discussed civic education, environmental education, ecological citizenship, or environmental awareness in the context of waste management within educational settings. Only articles published between 2015 and 2025 and written in English or Indonesian were included in this review.

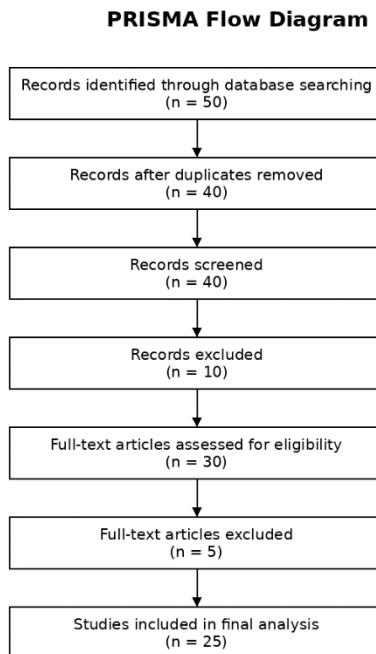
The exclusion criteria included studies that were not directly related to the research topic, such as those focusing solely on technical waste management without an educational component, non-scientific publications (e.g., blogs, opinion articles, or reports without peer review), duplicate articles retrieved from multiple databases, and studies with incomplete data or unclear research methodology. The application of these criteria ensured that only relevant and high-quality studies were included in the analysis [18].

## *2.3. Article selection process.*

The article selection process was conducted systematically to ensure transparency and reproducibility of the literature review. Articles were identified through searches in selected databases, including Google Scholar, ScienceDirect, SpringerLink, and Garuda, using predefined keywords related to the research topic. This initial search resulted in a preliminary pool of studies, with a total of 50 articles identified. Duplicate records were then removed to avoid redundancy, resulting in 40 unique articles.

Subsequently, titles and abstracts were screened to assess their relevance to the research objectives and inclusion criteria. During this stage, 10 articles were excluded due to lack of relevance to environmental education or waste management awareness, leaving 30 articles for further review. The remaining articles were then subjected to a full-text assessment to evaluate their suitability in greater detail. At this stage, 5 articles were excluded due to insufficient methodological clarity, limited focus on educational contexts, or incomplete data. Finally, 25 articles were included in the final analysis.

This multi-stage selection process, consisting of identification, screening, eligibility, and inclusion, enhances the rigor and credibility of the literature review [19]. Furthermore, the article selection process followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework to ensure transparency and methodological rigor. The PRISMA flow diagram illustrating this process is presented in Figure 1.



**Figure 1.** PRISMA flow diagram.

#### *2.4. Data extraction.*

Data extraction was conducted systematically using a structured framework to ensure consistency in capturing relevant information from each selected study. The extracted data included the authors and year of publication, research objectives, research design and methods, sample characteristics, key findings related to environmental education and waste management awareness, and the learning approaches or interventions applied. In addition, attention was given to identifying the context of each study, such as educational level (e.g., primary, secondary, or higher education) and type of environmental program implemented. This structured extraction process enabled effective comparison and synthesis of findings across different studies and supported the identification of patterns and trends in the literature [20–25].

#### *2.5. Data analysis.*

The data were analyzed using content analysis techniques to identify recurring themes and patterns across the selected studies. The analysis involved coding and categorizing findings into several key thematic areas, including the concept of ecological citizenship, the implementation of environmentally based civic education, learning strategies for promoting environmental awareness, and factors influencing students' waste management behavior. Furthermore, the analysis focused on identifying relationships between educational approaches and observed outcomes in terms of students' awareness and behavior. Through this thematic and interpretative analysis, the findings from various studies were synthesized to provide a comprehensive understanding of how civic education contributes to improving waste management awareness. This analytical approach allows for deeper interpretation beyond descriptive summaries and strengthens the validity of the study conclusions [7].

## 2.6. Bias minimization.

To strengthen the methodological rigor of the review, several steps were taken to minimize potential bias during the study selection and analysis processes. First, predefined keywords and explicit inclusion and exclusion criteria were used to reduce subjective judgment in identifying relevant studies. Second, multiple academic databases were used to broaden the scope of the search and reduce publication source bias. Third, the screening process was conducted in several stages, namely title and abstract screening followed by full-text assessment, to ensure that only studies meeting the research objectives were included. Fourth, data extraction was conducted using a structured framework to maintain consistency in recording study characteristics and findings. These procedures were intended to enhance the transparency, consistency, and reproducibility of the review process [26–29].

## 3. Results and Discussion

### 3.1. The concept of environmentally based citizenship education.

To facilitate a clearer understanding of the existing literature, Table 1 presented a summary of key studies, including their focus, methods, and main findings related to environmental citizenship and waste management awareness. The literature review showed that environment-based civics education evolved from a paradigm that focused not only on developing democratic citizens but also on fostering citizens who were responsible for environmental sustainability. From this perspective, civics education was understood not only as a learning process about political systems and the rights and obligations of citizens, but also as a character-building process that instilled values of social responsibility and concern for public issues, including environmental issues [8, 9]. This paradigm shift emerged alongside the increasing complexity of global environmental challenges, which increasingly threatened the sustainability of human life. Issues such as climate change, environmental pollution, and the growing volume of waste generated by human activities demonstrated that environmental crises were not only related to the technical aspects of resource management but were also closely linked to human behavior and low public awareness of environmental protection [1,2]. Therefore, education was viewed as a crucial instrument for developing ecological awareness within society from an early age.

**Table 1.** Summary of Key studies on environmental citizenship and waste management awareness.

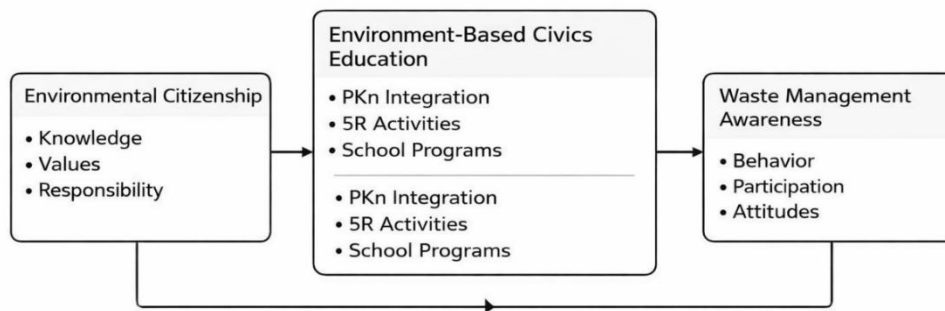
No	Author(s)	Year	Study Focus	Method	Key Findings
1	[14]	2020	Environmental citizenship in Adiwiyata schools	Quantitative	Environmental citizenship positively influences students' environmental behavior
2	[5]	2023	Environmental education outcomes	Review	Environmental education improves awareness and pro-environmental behavior
3	[23]	2020	Environmental learning approaches	Empirical	Contextual learning enhances ecological awareness
4	[17]	2024	5R waste management in civic learning	Experimental	5R-based learning increases waste management awareness
5	[11]	2025	Ecological citizenship and SDGs	Qualitative	Civic education fosters environmental responsibility
6	[28]	2021	Student environmental awareness	Survey	Active participation increases environmental awareness
7	[27]	2020	Youth environmental engagement	Mixed method	Participation strengthens environmental behavior
8	[29]	2022	Environmental citizenship education	Review	Integration into education improves ecological awareness

The concept of environment-based civics education was rooted in the theory of ecological citizenship, which emphasized individual moral responsibility toward the environment. As explained by [9], ecological citizenship positioned individuals as actors who not only had rights but also responsibilities to maintain environmental sustainability through daily actions that supported ecosystem preservation. This perspective expanded the concept of citizenship from a relationship between individuals and the state to a broader relationship involving individuals, society, and the global environment [10, 21]. Within this framework, citizens were not only expected to comply with environmental regulations but also to develop moral awareness to sustain the environment as part of their social responsibility. This demonstrated that environment-based civics education had a strong ethical dimension, as it aimed to shape individuals who not only understood the importance of environmental protection but also possessed a moral commitment to act accordingly. In educational practice, the concept of ecological citizenship could be implemented through learning approaches that encouraged students to understand the link between human activities and environmental sustainability [22]. Research by Ardoin et al. [5] showed that integrating environmental education into the curriculum increased ecological awareness and encouraged behavioral change. These findings were supported by Cincera et al. [23], who found that environment-based learning enhanced ecological awareness and pro-environmental behavior through contextual learning experiences.

Furthermore, environmental citizenship education was closely related to the concept of Education for Sustainable Development (ESD), which emphasized the role of education in building ecological awareness and promoting behaviors that supported sustainable development [6, 13]. The ESD framework positioned education as a strategic tool for preparing societies to address global challenges such as climate change, energy crises, and environmental degradation. Leicht et al. [24] explained that ESD focused not only on increasing environmental knowledge but also on developing critical thinking, problem-solving skills, and global awareness, enabling individuals to make environmentally responsible decisions. This suggested that integrating ESD into civics education strengthened its role in shaping a generation with ecological awareness and a commitment to sustainability. However, several studies indicated that integrating environmental education into civics education still faced significant challenges. Stevenson et al. [7] pointed out that although the concept of ecological citizenship had been increasingly adopted in education, its implementation in schools was often limited to cognitive aspects without sufficient practical learning experiences. This finding aligned with Wals and Benavot [25], who showed that environmental education was often treated as knowledge transmission rather than as a process of fostering ecological behavior.

These findings suggested that the success of environment-based civics education depended not only on the inclusion of environmental content in the curriculum but also on the use of participatory and practice-oriented learning approaches. Therefore, environment-based civics education needed to be designed in a contextual and participatory manner to foster stronger ecological awareness among students. The conceptual relationship was illustrated in Figure 2. Figure 2 illustrates the conceptual relationship between environmental citizenship and students' waste management awareness through environment-based civics education. Environmental citizenship, which includes knowledge, values, and responsibility, is developed through civics learning that integrates environmental values and practice-based activities such

as 5R implementation and school environmental programs. This process contributes to shaping students' behavior, participation, and attitudes toward responsible waste management.



**Figure 2.** Conceptual framework of the relationship between environmental citizenship, environment-based civics education, and students' waste management awareness.

#### 4. Implementation of Environmentally Based Citizenship Education in Schools

The implementation of environment-based education in schools was generally carried out through the integration of environmental content into learning and through participatory and contextual learning activities. The integration of environmental content into civics education enabled students to understand that protecting the environment was part of their responsibility as citizens [8,9]. Through this approach, the concept of citizenship was understood not only in terms of the relationship between citizens and the state but also in terms of citizens' responsibilities toward the environment. This indicated that civics education could serve as an important tool for building students' ecological awareness through the integration of environmental values into the learning process.

However, various studies indicated that the integration of environmental content into learning was often conceptual and did not fully encourage changes in student behavior. Research by Ardoin et al. [5] showed that environmental education focusing solely on increasing knowledge did not always result in significant behavioral change. This finding was further supported by Pooley and O'Connor [26], who reported that increased environmental knowledge was not consistently followed by changes in pro-environmental behavior. These findings highlighted a gap between environmental knowledge and behavior. Many students understood the importance of environmental protection but had not fully implemented environmentally friendly behaviors in their daily lives. This suggested that learning focused solely on cognitive aspects was insufficient to foster strong environmental awareness.

Conversely, learning approaches that actively engaged students in environmental activities tended to be more effective in raising ecological awareness. Research by Meiwindi et al. [17] showed that the implementation of waste management based on the 5R principles (Reduce, Reuse, Recycle, Replace, and Replant) in civics learning increased students' awareness of responsible waste management. These practice-based activities allowed students to gain firsthand experience in applying environmentally friendly behaviors. Furthermore, environmentally oriented school programs, such as Adiwiyata schools and waste banks, were also found to be effective tools for enhancing students' environmental awareness. Research by Gallay et al. [27] showed that student participation in environmental activities increased ecological awareness and encouraged active involvement in conservation efforts.

Research by Zsóka and Szerényi [28] also showed that students who were involved in environmental activities at school tended to have higher levels of environmental awareness than those who only received theoretical instruction. This demonstrated that direct experience in environmental activities played a crucial role in shaping environmentally responsible behavior among students. Therefore, the implementation of environment-based civics education in schools required the integration of theoretical learning with practical activities that enabled students to engage directly in environmental management practices. Building on these findings, Table 2 summarized various learning approaches and their effectiveness in improving students' waste management awareness within educational settings. As shown in Table 2, participatory and practice-based learning approaches tend to be more effective than purely theoretical instruction in improving students' waste management awareness.

**Table 2.** Learning approaches and their impact on waste management awareness.

No	Learning Approach	Educational Context	Activities	Outcomes on Waste Awareness	Reference
1	Integration in Civics Education	School curriculum	Environmental values in PKn	Increased awareness and responsibility	[11]
2	5R-Based Learning	Classroom & school practice	Reduce, Reuse, Recycle, Replace, Replant	Improved waste management behavior	[17]
3	Experiential Learning	School activities	Waste sorting, recycling	Behavioral change and participation	[28]
4	Adiwiyata Program	School system	Environmental culture & programs	Higher environmental awareness	[14]
5	Project-Based Learning	Classroom projects	Environmental campaigns	Increased engagement	[27]
6	Contextual Learning	Integrated subjects	Real-life environmental issues	Stronger ecological understanding	[23]

## 5. The Role of Civic Education in Increasing Awareness of Waste Management

The results of the literature review indicated that civics education played a crucial role in raising students' awareness of waste management. Civics education fostered environmental awareness through the development of values related to social responsibility and concern for the common good [9]. From a civics perspective, these values were not only related to the individual's relationship with the state but also encompassed responsibility toward the environment as part of a shared living space. Therefore, integrating environmental issues into civics education was essential for building students' ecological awareness and fostering a caring attitude toward environmental sustainability.

Stern [4] explained that individual behavior toward the environment was strongly influenced by social values and norms that developed within society. In this context, the development of environmentally friendly behavior depended not only on individual knowledge but also on social values that shaped perspectives toward the environment. In an educational context, civics education played a role in fostering these values through a learning process that emphasized social responsibility and concern for the common good. Through this process, students not only gained knowledge about environmental issues but were also encouraged to develop attitudes and behaviors that supported environmental preservation.

Research by Yusuf et al. [14] showed that students who understood environmental citizenship tended to exhibit more positive behaviors in maintaining a clean school environment. This suggested that an understanding of environmental citizenship influenced students' behavior in maintaining environmental cleanliness and sustainability. This finding was further supported by Aitken and Dickinson [29], who found that civics education

integrating environmental issues increased students' ecological awareness and encouraged participation in environmental conservation activities. Thus, civics education not only increased students' environmental knowledge but also contributed to the development of environmentally conscious attitudes and pro-environmental behavior. Furthermore, education that strengthened students' motivation and emotional awareness of environmental issues was shown to increase their involvement in concrete environmental actions [30].

Civics education also played a role in developing ecological citizenship among students. This concept emphasized that citizens had a moral responsibility to preserve the environment through concrete actions such as waste sorting, reducing plastic use, and participating in conservation activities [10, 31]. Ecological citizenship positioned individuals as responsible actors not only within their communities but also in relation to global environmental sustainability. In an educational context, this concept was implemented through learning approaches that encouraged students to understand the relationship between human activities and their environmental impacts.

Research by Navarro and Tidball [32] showed that environment-based citizenship education increased student participation in environmental management activities and encouraged more environmentally friendly behavioral changes. Participation in activities such as waste sorting, recycling programs, and school clean-up initiatives provided students with direct experience of the importance of environmental protection. These experiences played a crucial role in developing ecological awareness and strengthening students' sense of environmental responsibility. Therefore, environment-based civics education played a strategic role in building students' awareness of waste management by fostering social responsibility, reinforcing ecological citizenship, and providing participatory learning experiences.

Despite the generally positive findings reported across studies, several inconsistencies and gaps were identified. While many studies emphasized that environmental education improved students' awareness and pro-environmental behavior [5, 23], other findings indicated that increased knowledge did not necessarily translate into behavioral change [26]. This highlighted a persistent gap between cognitive understanding and actual environmental practice.

Furthermore, studies focusing on experiential and participatory learning approaches, such as 5R-based activities and school environmental programs, tended to report stronger behavioral outcomes compared to purely theoretical instruction [17, 28]. This suggested that practice-based learning was more effective in fostering sustainable behavior. However, most of these studies were conducted in specific institutional contexts (e.g., Adiwiyata schools), which might limit the generalizability of the findings.

Another important gap identified in the literature was the limited number of studies that explicitly integrated ecological citizenship into civics education to address waste management awareness. Most existing research focused either on environmental education in general or on science-based approaches, leaving civics education relatively underexplored in this context. This highlighted the need for further empirical research examining the role of civics education in promoting environmental responsibility and sustainable behavior.

## **6. Obstacles to the Implementation of Environmentally Based Citizenship Education**

Although environment-based civics education had significant potential to increase students' environmental awareness, its implementation still faced various challenges in school practice.

One major challenge was the limited integration of environmental issues into the civics curriculum. In many cases, civics instruction still focused primarily on cognitive aspects, leaving limited space for contextual and practice-based environmental learning [9]. This situation resulted in a learning process that emphasized theoretical understanding without being accompanied by experiences capable of shaping concrete attitudes and behaviors toward environmental protection. As a result, students understood the importance of environmental protection at the knowledge level but had not fully applied it in their daily lives.

This condition reflected a gap between the ideal goals of civics education—namely, the development of responsible citizen character—and actual learning practices, which remained oriented toward knowledge transfer. In principle, civics education should not only develop civic knowledge but also foster civic skills and civic dispositions that encourage students to actively participate in safeguarding the public interest, including environmental preservation.

Furthermore, limited supporting facilities, such as waste management infrastructure, and insufficient support for environmental programs in schools also hindered the implementation of environment-based civics education. Many schools lacked adequate systems, including waste sorting facilities, recycling programs, and structured environmental activities. Research by Ardoin et al. [5] showed that the success of environmental education programs was strongly influenced by institutional support and the availability of adequate facilities. Without such support, environment-based learning was difficult to implement effectively, as students lacked opportunities to directly practice environmentally responsible behaviors.

In addition to facilities, institutional factors and school culture also influenced the successful implementation of environment-based civics education. Schools that fostered a culture of environmental awareness tended to be more successful in instilling ecological values in students compared to those without integrated environmental programs. Therefore, the implementation of environment-based civics education depended not only on classroom instruction but also on support from the broader school ecosystem.

Another key factor affecting implementation was the limited training of teachers in integrating environmental values into learning. Teachers played a crucial role as facilitators who connected civics concepts with real-world environmental issues. However, in practice, many teachers lacked sufficient understanding of integrative and interdisciplinary learning approaches. Research by Fischer and Barth [33] showed that the success of education for sustainable development depended heavily on teachers' readiness to incorporate sustainability issues into their teaching. Teachers with stronger competencies in sustainability education were better able to design contextual and participatory learning experiences, thereby encouraging students' active involvement in environmental activities.

Overall, the challenges in implementing environment-based civics education were not limited to curriculum issues but also included inadequate facilities, weak school culture, and limited teacher readiness. Therefore, more systematic efforts were required to strengthen the integration of environmental education into civics education through the development of contextual curricula, the provision of adequate facilities, and the enhancement of teachers' capacities to implement environment-based learning.

## **7. Limitations of the Review and Future Research Directions**

This study had several limitations that should be acknowledged. First, the literature search was limited to selected academic databases, namely Google Scholar, ScienceDirect, SpringerLink,

and Garuda. Although these databases provided broad coverage, relevant studies indexed elsewhere might not have been included, potentially affecting the comprehensiveness of the review. Second, only articles published in English and Indonesian were included, which may have introduced language bias by excluding relevant studies in other languages.

Third, although a systematic approach was applied, the selection and interpretation of studies might still have involved a degree of subjectivity, potentially introducing selection bias. Additionally, the reviewed studies varied in terms of research design, context, and sample characteristics, making it difficult to generalize the findings across different educational settings. Fourth, most studies focused on specific programs or institutional contexts, such as environmentally oriented schools, which might not fully represent general school conditions, thereby limiting external validity.

Based on these limitations, future research should conduct empirical studies examining the integration of ecological citizenship into civics education across diverse educational contexts. Comparative studies across regions and educational levels are also needed to better understand the effectiveness of different learning approaches. In addition, future research should explore the longitudinal impacts of environment-based civics education on students' behavior to provide deeper insights into its sustainability and long-term effectiveness..

#### **4. Conclusions**

Environment-based civics education played a strategic role in increasing students' awareness of waste management within the school environment. The integration of environmental values into civics learning enabled students to understand that environmental protection was part of their civic responsibility. Through this approach, civics education not only increased students' knowledge of environmental issues but also contributed to shaping environmentally responsible attitudes and behaviors through the development of social responsibility and ecological citizenship. The implementation of environment-based civics education was achieved through the integration of environmental content into learning, practice-based activities such as 5R-based waste management (Reduce, Reuse, Recycle, Replace, and Replant), and environmentally oriented school programs that encouraged active student participation. However, its implementation still faced several challenges, including limited curriculum integration, inadequate waste management facilities in schools, and limited teacher competence in integrating environmental values into teaching. Therefore, more systematic efforts were required to strengthen the implementation of environment-based civics education through the development of contextual curricula, enhancement of teacher capacity, and provision of adequate policy support and facilities. These efforts would enable civics education to play a more optimal role in fostering students' ecological awareness.

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## Author Contribution

Bherrio Dwi Saputra and Wachid Pratomo contributed to the conceptualization, methodology, data collection, supervision, and funding acquisition of the study, while Bherrio Dwi Saputra, Wachid Pratomo, and Ficky Adi Kurniawan contributed to data analysis, writing of the original draft, and manuscript review and editing. Bherrio Dwi Saputra and Wachid Pratomo served as the main contributors, while Ficky Adi Kurniawan provided supporting contributions, particularly in manuscript review and refinement.

## Competing Interest

The authors declare that there are no financial, personal, or professional relationships that could be construed as potential conflicts of interest in relation to this study. All authors confirm that the research was conducted independently and objectively. No external influence has affected the design, analysis, or reporting of this work.

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