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IMPLEMENTATION OF RECYCLING-BASED ENVIRONMENTAL EDUCATION IN BUILDING AWARENESS OF FLOOD DISASTER RESILIENCE IN STUDENTS OF SDN 3 KENANGA

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Abstract

Aims. This study aims to describe the implementation of recycling-based environmental education in fostering flood disaster resilience awareness among elementary school students. The program was conducted as a community service activity through the Kuliah Kerja Nyata (KKN) at SDN 3 Kenanga Village, Cirebon Regency, involving fifth-grade students as participants.

Methods. This study employed a descriptive qualitative approach, with data collected through observation, questionnaires, and documentation. The educational program was designed in three stages: introduction (providing materials on waste, floods, and the 3R concept); implementation (hands-on recycling activities that transform used gallons into plant pots and trash bins using a STEAM approach); and sustainability action (utilizing students' products in school facilities).

Result. The findings indicate that the program effectively improved students' understanding of the relationship between waste management and flood risk, as reflected in questionnaire responses and active participation. In addition, positive behavioral changes were observed, such as increased adherence to proper waste disposal and a growing awareness of the need to remind peers to maintain cleanliness.

Conclusion. The recycling activities also enhanced students' creativity and sense of environmental responsibility. Therefore, participatory and experiential recycling-based environmental education proves to be an effective strategy for building early flood-disaster resilience awareness. This program has the potential to be developed as a sustainable model for environmental and disaster education at the elementary school level.

Keywords: environmental education, recycling, disaster resilience, flood, elementary school



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INTRODUCTION

Floods are one of the most frequent hydrometeorological disasters in various regions of Indonesia and have a significant impact on people's lives. This phenomenon not only causes damage to infrastructure and economic losses, but can also disrupt social activities and endanger public safety. Based on data from the National Disaster Management Agency (BNPB), disaster events in Indonesia are always above 2000 events every year, with hydrometeorological disasters as the most dominant type of disaster. In December 2025, there were 4,727 disaster events, of which around 99.26% were hydrometeorological disasters. Of these, floods occupy the highest position with 2,009 incidents or around 42.50% of the total disaster events that occurred (BNPB, 2025). The data shows that floods are still a serious threat that requires attention from various parties. This condition requires preparedness and mitigation efforts involving all levels of society. What's more, this potential disaster will have an impact on people's lives, especially for high-risk

groups, including children. Based on BNPB data in 2025, around 31% of the victims who died and went missing due to disasters in the first two months were children, mostly due to floods and landslides (Putri & Muttaqin, 2025). The data shows that children have a fairly high level of vulnerability to disasters, so efforts to increase awareness and preparedness for flood disasters need to be carried out from an early age through appropriate and sustainable disaster education.

In this context, schools have a strategic role as an institution that can carry out educational interventions in a sustainable manner. School is an environment where children spend most of their time learning and interacting with peers, making it an effective space to form positive habits related to clean and healthy living behaviors. (Daniah et al., 2019) states that Through education in schools, the values of caring for the environment can be instilled in a structured and sustainable manner. In addition, school children are also the next generation who need to be equipped with knowledge and skills that support environmental sustainability. Data from the Central Statistics Agency shows that the number of school-age children reaches around 80.29% of the total population of Indonesia, which means that this group has great potential as agents of change in society (GoodStats, 2025). Through proper education, students can become pioneers in implementing clean and healthy living behaviors, not only in the school environment but also in the family and the wider community.

However, the great potential of schools as agents of change has not been optimal, because various studies have shown that students' awareness of environmental cleanliness is still relatively low. In fact, at the elementary school level, environmental education is very crucial because students are in the early development phase in forming habits and values related to environmental care behavior. Unfortunately, findings on the ground show a gap between expectations and reality. Research conducted by Purnomo et al. (2017) at an elementary school in the Argomulyo area, Sedayu, Bantul found that around 70–80% of the observed waste was still mixed and not separated according to its type, this shows that students do not understand the importance of waste sorting. Further, the research Siskayanti & Chastanti (2022) at SD Negeri 20 West Blade also revealed that students' knowledge of the type of waste only reached 37.38%, while the understanding of the 3R concept (*Reduce, Reuse, Recycle*) only reached 45.27%, which is included in the low category.

The low environmental awareness in these students does not stand alone, but is influenced by various factors that are interrelated with each other. Research Raharjo & Indarjo (2014) at SD Negeri Banjarsari 02, Pati, proves that there is a significant relationship between knowledge,

attitudes, and availability of facilities with the implementation of Clean and Healthy Living Behavior (PHBS) of disposing of garbage in its place. This means that the low knowledge and attitude of students and the limited facilities also contribute to poor hygiene behavior in the school environment.

One form of implementation of environmental education that can be applied in elementary schools is through recycling activities. Recycling is the process of reusing materials or goods that are no longer used into products that have new use value. This activity not only serves to reduce the amount of waste, but can also be a contextual learning medium for students. Through recycling activities, students can learn firsthand about the importance of waste management and understand that waste that is not managed properly can cause various environmental problems. Practice-based learning like this is considered more effective for elementary school students because it provides a real and easy-to-understand learning experience. Various studies have also proven the effectiveness of this approach. Such as research conducted by Yusnan et al. (2023) in MIN 1 Baubau showed that the use of used goods as a learning medium succeeded in increasing students' creativity, with 12 out of 34 students achieving a score of 100 in making media such as simple scales from hangers and artworks from paper. Then, Mumpuni et al. (2022) at SDN 1 Sibrama, Banyumas, showed that second-hand goods-based learning media is effective in improving students' numeracy literacy in understanding the concept of division and multiplication.

The effectiveness of waste recycling activities as a learning medium is becoming increasingly relevant when associated with disaster mitigation efforts, considering that the problem of poor waste management is often correlated with the occurrence of floods. Garbage that accumulates and clogs waterways can hinder the flow of water, increasing the risk of flooding, especially in residential areas that have suboptimal drainage systems (Fadillah et al., 2024; Saputra et al., 2025; Suarmika & Utama, 2017). Therefore, efforts to reduce waste through recycling activities can be one of the simple steps that can be taken to reduce the potential for these problems. In the context of education, this activity can be used as a medium to introduce students to the relationship between human behavior towards the environment and the possibility of disasters. In other words, environmental education combined with recycling practices not only aims to increase environmental awareness, but can also be a means of building students' awareness of the importance of protecting the environment as part of efforts to reduce the risk of flood disasters.

Awareness of the relationship between waste and floods is in line with the concept of disaster resilience that needs to be instilled from an early age. Disaster resilience is the ability of individuals or communities to understand disaster risk, adapt to the conditions that occur, and have preparedness in dealing with the possibility of disasters (Bachri et al., 2024; Ginting et al., 2025; Putri & Muttaqin, 2025; Qodir et al., 2023; Rahmat et al., 2023; Suarmika & Utama, 2017). Raising awareness of disaster resilience from elementary school age is important so that students have an initial understanding of how to protect the environment and realize that daily behavior can affect the conditions of the surrounding environment. Research Ginting et al. (2025) in Tanah Karo, North Sumatra, in collaboration with local PMI, also proved that disaster mitigation socialization can increase children's knowledge from 52.7% to 62.5% and emergency response readiness from 14.5% to 15.6%.

Disaster learning media innovations also continue to be developed to increase the effectiveness of education. A creative approach is also needed in delivering disaster materials to children. Bachri et al. (2024) develop *Snake Board Edu-Game* at SDN Jambewangi 3, Banyuwangi, which is located near Mount Raung. This interactive learning media in the form of a modification of the snake and ladder game succeeded in increasing students' understanding of various types of disasters with a high level of enthusiasm. Rahmat et al. (2023) also introduced the BLU-DISCARE (Budi Luhur Disaster Care) innovation with a systematic workflow: *Risk Mapping, Organizing, Educating, and Advocating*, whose implementation includes counseling, the kamishibai method (illustrated fairy tale), evacuation simulations, and relief search simulations. Meanwhile, Nurfadila et al. (2025) in their research emphasized STEAM approach (*Science, Technology, Engineering, Arts, Mathematics*) that are integrated in recycling projects have also proven to be effective in developing creativity as well as entrepreneurial skills by involving students in making pots from used gallons that integrate the *Science, Technology, Engineering, Arts, and Mathematics*. In addition, hands-on practice-based learning methods or *Learning by doing* applied by Pradana & Azizah (2026) proved to be more effective than the theoretical lecture method. This is in line with Bandura's social learning theory and habituation theory which asserts that repetitive behaviors will develop into habits (Pradana & Azizah, 2026).

However, from the description of the research that has been presented, it can be seen that previous studies are still partial and have not fully integrated environmental education, recycling practices, and flood disaster mitigation. Study on garbage disposal behavior by Kesuma et al.

(2025) and Raharjo & Indarjo (2014) only focusing on the factors of knowledge, attitudes, and facilities without linking them to flood mitigation efforts. Research on the use of used goods by Mumpuni et al. (2022), Tiurlina & Fatihatusyidah (2023), and Yusnan et al. (2023) emphasizes more aspects of creativity and learning media, but it has not been directed to building disaster awareness. Meanwhile, a study on disaster mitigation by Bachri et al. (2024), Ginting et al. (2025), and Putri & Muttaqin (2025) It is still limited to simulation and hands-on education without integrating recycling practices as a long-term preventive effort. Contextually, the research locations are spread across various regions such as East Java, Central Java, Banten, North Sumatra, East Kalimantan, and Southeast Sulawesi, but nothing has been done in the flood-prone area of Cirebon Regency. In addition, the duration of the previous research intervention was one-time or short training, so it paid less attention to the sustainability aspect of the program.

Based on these various problems, educational efforts are needed that not only focus on imparting knowledge, but also provide direct experience to students in managing waste and understanding its relationship with flood disaster risk. Therefore, this study will integrate three approaches that have been proven to be effective separately: educational approach (Putri & Muttaqin, 2025) Direct Practice Approach/*Learning by doing* (Pradana & Azizah, 2026) and STEAM-based creative approaches (Nurfadila et al., 2025) in one integrated program. This activity was carried out as part of the community service program through the Real Work Lecture (KKN) of Gunung Jati Swadaya University in the Kenanga Village group. This educational program is designed in stages for three days by involving 5th grade students at SDN 3 Kenanga Village, Sumber District, Cirebon Regency. Through this program, it is hoped that students will not only understand the importance of maintaining environmental cleanliness, but also realize the relationship between the behavior of throwing garbage and the risk of flood disasters, as well as have practical skills in utilizing used goods through recycling activities. Apart from being a form of real contribution to society, this activity is also a means to conduct scientific studies on how the implementation of recycling-based environmental education can increase awareness of flood disaster resilience in elementary school students. Thus, the service activities carried out not only provide direct benefits to the school environment and the community, but also produce research findings that can be a reference in the development of environmental education and disaster mitigation at the elementary school level.

METHODS

This research uses a qualitative approach with a type of descriptive research carried out in the form of community service through the Real Working Group program or can be referred to as the Thematic KKN of Gunung Jati Swadaya University Kenanga Village Group. This approach is used to understand and describe in depth the phenomena that occur in the research subject in a natural context. According to Moleong (2021) Qualitative research aims to understand the various social phenomena experienced by the research subject, such as behaviors, perceptions, and actions which are then described in the form of words. In this study, community service activities were realized through a waste recycling-based environmental education program that aims to increase awareness of flood disaster resilience in elementary school students. Through these activities, the implementation team not only carried out educational programs, but also made observations and scientific reflections on the process and impact of the activities carried out. In addition, this research is also designed as a case study with an educational, participatory and also experience-based approach (*Experiential Learning*). This design was chosen because the research can explore in depth a program or activity in a specific context (Creswell, 2018). The focus of this research is the implementation of a recycling-based environmental education program that aims to build awareness of flood disaster resilience in elementary school students.

The service activity was carried out at SDN 3 Kenanga Village, Sumber District, Cirebon Regency, West Java, which is also the area for the implementation of the UGJ KKN of the Kenanga Village group. The subject of the activity is the selected grade V students because at that age the students already have sufficient cognitive ability to understand environmental concepts as well as adequate motor skills to participate in recycling practice activities. In addition, students at this level are considered to have the potential to cultivate the habit of caring for the environment from an early age.

This environmental education program is carried out in 3 stages, which are as follows:

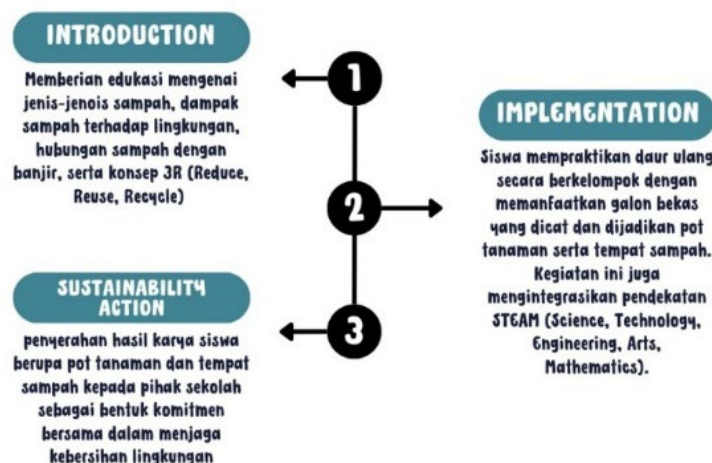


Figure 1. Stages of the Kenanga KKN Environmental Education Program

Source: Author, 2026

The first stage is *introduction*, which is to provide education about the types of waste, the impact of waste on the environment, the relationship between waste and floods, and the concept of 3R (*Reduce, Reuse, Recycle*) through lecture methods and educational video screenings to be more interactive. The second stage is *implementation*, which is a group recycling practice activity by utilizing used gallons that are painted and used as plant pots and garbage cans. This activity also integrates the STEAM (*Science, Technology, Engineering, Arts, Mathematics*) approach. The third stage is *sustainability action*, this stage is realized by handing over student works in the form of plant pots and garbage cans to the school as a form of joint commitment in maintaining environmental cleanliness.

The data collection techniques used in this study include observation and questionnaires. Observation was carried out by directly observing student participation and activity during educational activities, the process of student creativity in recycling practices, interactions between students in group work, behavioral changes seen during activities, and school environmental conditions related to cleanliness and waste management. This observation was participatory because the researcher was directly involved in the activities during the three days of the program. In addition to observation, the researcher also used questionnaires or questionnaires given to students after participating in the entire series of activities. The questionnaire was prepared to explore the students' responses to the activities that have been carried out and to find out their level of understanding and awareness about the relationship between waste and floods after participating

in the program. The questionnaire uses a Likert scale with closed-ended questions designed according to the level of comprehension of elementary school students. Documentation is also carried out as supporting data by collecting photos and videos during the activity, the results of student recycling work, and field notes during the research process.

DISCUSSION

The environmental education program with the theme "Building Flood Disaster Resilience Early Through Education and Recycling" was carried out for three days to students in grades 5A and 5B at SDN 3 Kenanga Village, Sumber District, Cirebon Regency. This activity is part of the Real Work Lecture (KKN) program of Swadaya Gunung Jati University of the Kenanga Village group which aims to instill environmental awareness and build an initial understanding of flood disaster mitigation in elementary school students.

The program is designed using an educational, participatory, and experiential approach (*Experiential Learning*). This approach was chosen because elementary school students are at the stage of concrete operational cognitive development, students find it easier to understand concepts through direct experience compared to abstract explanations. This is in line with Jean Piaget's theory of learning (Suprihatien et al., 2024), which states that elementary school-age children learn more effectively through real activities and direct interaction with the environment. In addition, the program also integrates the concept of social learning (*Social Learning Theory*) from Albert Bandura, who emphasized that children's behavior can be formed through a process of observation, imitation, and direct experience. By involving students in practical activities such as recycling and planting plants, it is hoped that experiences can be formed that can strengthen the internalization of environmental care values.

The internalization of the values of environmental concern through observation and direct experience requires a conducive social environment as a learning 'laboratory' for students. This conducive environment is not only created in the classroom, but also requires synergy from various elements of society. It is in this context that *the pentahelix approach* becomes a relevant analytical framework to understand how collaboration between academics, government, society, the private sector, and the media can strengthen the effectiveness of disaster education programs. The QuadrupleHelix theory, which later developed into *Pentahelix*, is social innovation and sustainable development that explains that if we want to succeed in achieving sustainable development, it

requires the synergy of five main actors, namely *academic, business, community, government, and media*. In this program, the *pentahelix element* is reflected through the involvement of academics, namely the KKN team as an educational agent, the community (students and teachers), the government (the village apparatus that facilitates), and the media (documentation and publication of activities) as part of efforts to build collective awareness of disaster risk.

Introduction stage



Figure 2. Socialization and screening of environmental education videos
Source: personal documents

The first stage of the program began with socialization activities regarding the causes of flooding, the impact of waste on the environment, and simple ways that can be done to prevent flooding. The material is delivered through a communicative approach using visual media in the form of educational images and videos to make it easier for students to understand. The selection of visual media is based on the multimedia cognitive theory of Richard E. Mayer (2001)(Suprihatien et al., 2024) which states that learning is more effective when information is presented through a combination of words and pictures, as it can reduce cognitive load and help the brain process information more deeply.

During the socialization process, the observation results showed that students showed a fairly high level of attention and participation. Students were seen actively answering questions and relating the material presented with their experiences related to flood events in the surrounding environment. This shows that the contextual learning approach used is able to help students

understand the relationship between human behavior and environmental conditions. In the perspective of the theory of social constructivism from Vygotsky (1978) (Fauziah & Zuhri, 2025; Yuliana & Pangastuti, 2024), an effective learning process occurs when children can relate new knowledge to real experiences they have, as well as when they can actively interact within *zone of proximal development* with the help of educators as facilitators.

The results of the questionnaire given after the activity showed that this educational program succeeded in increasing students' understanding of the causes of flooding.

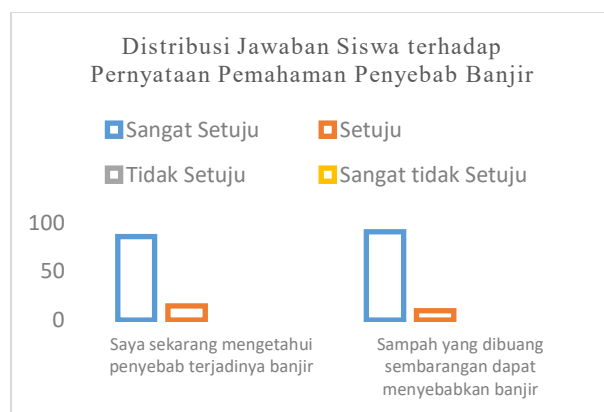


Chart 1. Distribution of Student Answers to the Statement of Understanding of the Causes of Flooding

These findings show that socialization activities are able to increase students' cognitive awareness regarding the relationship between waste management and flood risk. From the perspective of environmental education, increasing knowledge is an important initial stage in shaping changes in individual attitudes and behaviors towards the environment. The environmental behavior model of Hungerford and Volk (1990) asserts that pro-environmental behavior change begins with the mastery of variables *entry-level* in the form of basic knowledge about environmental issues (Fitriani et al., 2023). Therefore, in the absence of adequate cognitive understanding, it is difficult for individuals to develop concern and commitment to environmental action. Then, when viewed from the perspective of disaster resilience building, this increased understanding is the initial foundation in building individual capacity in dealing with flood risk. World Conference on Disaster Reduction (2015) in *Hyogo Framework for Action* emphasizes that knowledge of disaster risk and its causative factors is a key component in building a culture of safety and resilience (*culture of safety and resilience*) at the community level, including in the school environment.

Implementation stage



Figuree 3. Build implementation Recycled Products
Source: personal documents

The second stage of the activity was carried out through the practice of using used plastic gallons into plant pots and garbage cans. At this stage, students are divided into several small groups so that they can work together in the process of making recycled products. This group division is based on the cooperative learning theory of Johnson & Johnson (1994) (Nafilata et al., 2025) which states that interaction in small groups can improve social skills, individual responsibility, and academic achievement through a process of positive interdependence.

This activity provides a direct learning experience to students about the use of used goods. During the activity process, students showed high enthusiasm in the process of painting and decorating used gallons. The creativity of the students can be seen from the various motifs and colors they use in decorating pots and trash cans. Through this practice, it is proven that the theory *multiple intelligences* from Gardner (1983) (Berliana & Atikah, 2023), this activity accommodates visual-spatial intelligence which is reflected through the activity of decorating recycled pots, then interpersonal intelligence is also seen in how students act through group work, and finally is naturalistic intelligence which is also seen when students decorate pots with things that are naturalistic this proves that with this used gallon recycling activity can improve understanding of the environment.

From an educational point of view, this activity reflects the application of the *Learning by doing*. It is a learning method that emphasizes direct experience as the main means of understanding a concept. This concept was first introduced by John Dewey (1938) (Haryati & Makarim, 2025) which affirms that education should be centered on real experience (*Experience-based education*) because knowledge is inseparable from action. Through this recycling practice, students not only understand the concept of waste management theoretically, but also experience firsthand how waste can be repurposed into useful products.

This approach is also in line with the concept of STEAM (*Science, Technology, Engineering, Arts, and Mathematics*) in education. In this activity, the elements *Science* seen in the understanding of the environment and plants, *Engineering* in the process of modifying gallons into pots, *Arts* in the activities of decorating the pot, as well as *Technology* on the use of used materials into new products. Yakman (2008) (Lestari et al., 2026) in development *Framework STEAM* emphasizes that the integration of the arts in science and technology education can foster creativity and innovation, which are essential skills in the face of the challenges of the 21st century.

The results of the questionnaire show that this practical activity provides a positive experience for students, as seen in the following table:

Table 1. Distribution of Students' Answers to the Experience of Recycling Practice Activities

Statement	Strongly agree	Agree	Disagree	Strongly Disagree
I want to do recycling activities at school	71,4%	19%	9,5%	0%
I want to take care of the plant pots and trash cans that have been made	85,7%	14,3%	0%	0%

Source: primary data, 2026

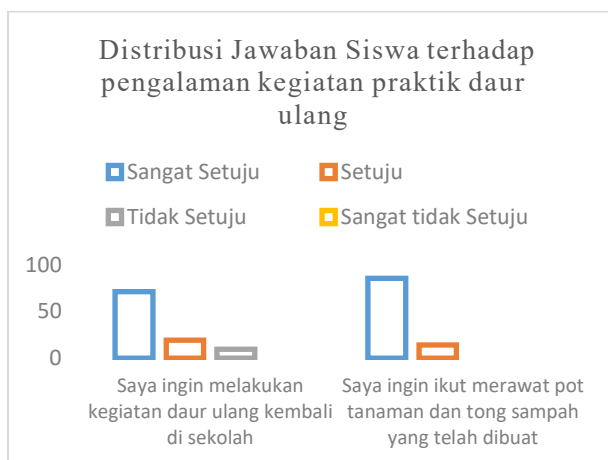


Chart 2. Distribution of Students' Answers to the Experience of Recycling Practice Activities

These findings suggest that direct involvement in recycling activities can increase students' sense of responsibility towards the environment as well as foster their interest in engaging in similar activities in the future. Within the framework of affective theory of environmental education, Hines, Hungerford, and Tomera (1987) in *the Model of Responsible Environmental Behavior* stated that intention to act is a strong predictor of responsible environmental behavior. This intention is formed through a combination of knowledge, skills, and positive affective experiences of environmental activities.

From the perspective of *pentahelix* collaboration, this stage of practice involves various elements indirectly. The *community element* is represented by students and teachers who actively participate. The *academic element* is represented by the KKN team who design and facilitate activities. The *government element* is reflected in the support of the village apparatus and the Education Office in granting implementation permits. The media element is present through documentation of activities which are then published as a form of public education. This collaboration demonstrates that effective disaster risk reduction programs require multi-stakeholder synergy, as affirmed in the *Sendai Framework for Disaster Risk Reduction 2015-2030* which advocates an *all-of-society engagement* approach in building disaster resilience.



Figure 4. Submission of the results of student recycled products to the school
Source: personal documents

Sustainability Action Stage

The third stage is the implementation stage of student work. At this stage, the pots that have been made are then planted with mango tree seedlings, while the garbage cans produced from recycling activities are placed in the school environment as a facility to support environmental cleanliness. The selection of mango tree seedlings is not only symbolic, but also has ecological and economic value in line with the concept of sustainable *greening*.

The handover of plant pots and garbage cans to the school is a symbol of the joint commitment between students, the school, and the service team in maintaining the cleanliness of the school environment. In addition, this activity also gives students a sense of ownership of the facilities they make themselves. In environmental psychology, the concept *place attachment* or attachment to a place explains that individuals tend to be more concerned and responsible for the environment that has emotional value or personal involvement (Yunita et al., 2024). By involving students in the process of creating a cleaning facility, the program indirectly builds an emotional attachment that can drive long-term maintenance behaviors.

The results of the questionnaire show a change in student behavior after participating in this activity, as seen in the following table:

Table 2. Distribution of Students' Answers to Post-Activity Changes

Statement	Strongly agree	Agree	Disagree	Strongly Disagree
After this activity, I often throw garbage in its place	76,2%	19%	4,8	0%
I will remind my friends if they throw garbage carelessly	71,4%	28,6%	0%	0%

Source: primary data, 2026

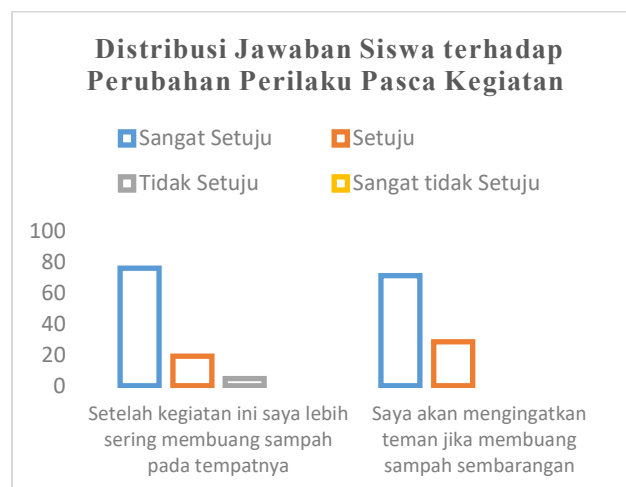


Chart 3. Distribution of Students' Responses to Post-Activity Behavior Change

These findings suggest that the change in attitudes that occurs is not only at the individual level, but also begins to develop into a collective consciousness among students. A total of 15 students stated that they strongly agreed that they would remind their friends if they threw garbage carelessly. This indicates the internalization of environmental values that are beginning to develop into social norms in peer groups. In the theory of social norms from Cialdini (1990) (Pambudi & Wisuantari, 2021), pro-environmental behavior can be strengthened through the formation of *Injunctive Norms*, i.e. beliefs about what others in a social group approve or disapprove of. When students remind each other not to litter, they are building social norms that support environmentally caring behavior.

From the perspective of habituation theory, behaviors that are repeated in a supportive environment can develop into habits. Bourdieu (1977)(Bailey et al., 2013) The concept of habitus explains that practices that are carried out repeatedly in a social environment can be embedded in individuals and become automatic patterns of behavior. By providing garbage can facilities made by students and involving them in the process of making them, this activity indirectly creates a learning environment that supports the formation of cleanliness habits. In context *Pentahelix*, this stage of implementation involves wider synergy. The school (*Community*) is committed to maintaining the facilities that have been created. KKN Team (*Academic*) conducting post-activity monitoring and evaluation. Village apparatus (*government*) provide program sustainability support through environmental policies at the village level. In fact, there is potential for private sector involvement (*Business*) in the procurement of plant seeds or material support for similar activities in the future. This collaboration is in line with the concept *Collaborative Governance* in disaster management (Ansell & Gash, 2008) which emphasizes the importance of multistakeholder partnerships in addressing complex public challenges such as disaster risk.

When associated with the concept of disaster resilience, this activity has an important role in building students' initial awareness of the relationship between human behavior and disaster risk. Disaster resilience is not only concerned with disaster preparedness, but also includes the individual's ability to understand factors that can increase or decrease disaster risk.(Scott, 2011) Define disaster resilience as the capacity of an individual or community to anticipate, survive, respond to, and recover from the impact of a disaster. This capacity is built through a combination of knowledge, skills, and resources that enable individuals to reduce their vulnerability to disasters. Therefore, through environmental education activities combined with recycling practices, students

are invited to understand that simple actions such as throwing garbage in its place and reusing used items can contribute to maintaining environmental balance. In the framework of disaster education, this program is included in the category *awareness-raising and capacity-building* at the basic level. UNESCO and UNICEF (2012) in the guide *Disaster Risk Reduction in School Curricula* emphasizing that disaster education must begin at an early age and be integrated with students' daily lives to be more meaningful and applicative. The students' open answers in the questionnaire also reinforced these findings.

Table 3. Summary of Student Open-ended Answers on Learning and Action Plan

Answer categories	Frequency	Example statement
Not littering	18	"I've learned that trash can cause flooding."
Keeping the environment clean	15	"Must be diligent in cleaning the school"
Planting and caring for plants	12	"The mango tree should be watered every day"
Recycling waste	10	"Used gallons can be a good pot"
Invite friends to take care of the environment	8	"I'll tell my friends to take care of the trash"

Source: Primary data, 2026 (N=21 students, open-ended answers can cover more than one category)*

These findings show that educational programs that integrate knowledge, hands-on experience, and creative practices are able to increase students' understanding and awareness of the importance of protecting the environment as part of flood disaster mitigation efforts. In the transformative theoretical perspective of Mezirow (1997), meaningful learning occurs when individuals experience a change in perspective through critical reflection on experience. This activity provides a space for students to reflect on their daily behaviour and develop a new perspective on the relationship between individual actions and collective impacts on the environment.

From the perspective of *community-based disaster resilience* development, student involvement as agents of change in the school and family environment has a significant *multiplier effect*. Twigg (2007) in *Characteristics of a Disaster-Resilient Community* emphasizes that a disaster-resilient community is a community that has the knowledge, awareness, and capacity to act. By instilling these values from an early age, the program contributes to the formation of a generation that is more environmentally conscious and ready to face the challenges of climate change in the future.

Within the broader *pentahelix* framework, the sustainability of this program requires the commitment of all parties. Academics (KKN team and universities) can continue to provide assistance and further research. The government (Education Office and BPBD) can integrate this material into the local content curriculum or disaster safe school program. The community (school committee and parents) can support the strengthening of behavior at home. The media can publish these good practices as an inspiration for other schools. The private sector can contribute through CSR programs that support environmental and disaster education. This *ongoing pentahelix* collaboration will ensure that the educational program is not only ceremonial, but truly builds long-term disaster resilience. Write down the *scientific findings* obtained from the results of the research that has been carried out but must be supported by adequate data. The scientific findings referred to here are not the data obtained from the research results. The scientific findings should be scientifically explained including: What are the scientific findings obtained? Why is that possible? Why is variable trend like that? All these questions must be explained scientifically, not only descriptively, if necessary supported by adequate basic scientific phenomena. In addition, it must also be explained that it is comparable to the results of other researchers who have almost the same topic. The research results and findings must be able to answer the research hypothesis in the preliminary section.

CONCLUSION

This environmental education program as a whole proves that a participatory and practice-based approach to environmental education can be an effective strategy in building disaster resilience awareness from an early age. In addition to providing direct benefits to the school environment, this program also contributes to shaping environmental care behaviors in students who are expected to continue to develop in their daily lives. The success of this program provides policy implications that disaster education in primary schools needs to be designed holistically, involve various stakeholders, and prioritize hands-on experience as the main learning method. Thus, investing in environmental education from an early age is not only an investment for an individual's future, but also an investment in the resilience of communities in the face of future disaster threats.

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