*Jurnal Penelitian Ilmu-Ilmu Sosial*
https://journals2.ums.ac.id/sosial
Volume 7, No. 1, 2026, 115-132
p-ISSN: 1411-5182, e-ISSN: 2830-1501

**Research Article**

# Environmental Reflexivity, Youth Participation, and Inclusive Sustainability Education: Learning from School-Based Waste Bank Initiatives

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Citation: Kim, S. C., Nardion, L., Pamungkas, M. D, Xavier, C. (2026). Environmental Reflexivity, Youth Participation, and Inclusive Sustainability Education: Learning from School-Based Waste Bank Initiatives. *Jurnal Penelitian Ilmu-Ilmu Sosial*. 7(1), 115-132. 10.23917/sosial.v7i1.16323

**Article History:**
Received: February 19, 2026
Revised: May 11, 2026
Accepted: June 27, 2026
Available Online: June 29, 2026

**Abstract**
Although the environmental crisis has emerged as a global issue, student involvement in environmental activism remains restricted. This study aims to examine the background and forms of environmental reflexivity of students of Maitreyawira High School, Batam, who are involved in the Baswira waste bank program. This study used a qualitative approach to collect data through observation, in-depth interviews, and document analysis of eight participants. The results show that the background and the nature of the students' activities were derived from their daily experience and social interaction in the waste bank activities. Consequently, ecological consciousness and responsible behaviour towards the environment have developed gradually. The waste bank programme also functions as a social space for inclusive learning and encourages students to participate actively in sustainability practices. This study highlights the significance of the practical potential of school-based environmental education for the formation of environmental responsibility and the development of sustainable communities.

**Keywords**: *environmental reflexivity, inclusive education, waste bank, youth agency, sustainability*

## Introduction

The environmental crisis has become an urgent global issue because of its far-reaching impact on human well-being and the stability of ecosystems. The crisis is expressed through a series of complex problems such as deforestation, pollution, climate change and the unsustainable use of natural resources that threaten the sustainability of life in general (IPCC, 2021; Lobo, 2025; Singh & Singh, 2017). Hence, a multi-dimensional approach is required to achieve effective solutions. One of these challenges is plastic waste, which is particularly problematic due to its non-biodegradable nature and exponentially growing consumption rates (Hakim, 2019). According to the FAO and UNEP (2020), global waste generation is estimated at 2.1 to 2.3 billion tonnes annually. Furthermore, the Ministry of Environment and Forestry (2020) stated that Indonesia was the second-largest contributor of marine plastic waste globally with approximately 3.22 million tons, preceded by China, which contributes 8.22 million tons. The data suggest that public ignorance is a significant issue and that human carelessness is the main cause of the environmental crisis (Ramdani et al., 2024). If this issue is not addressed seriously, it will threaten the very survival of the humans.

Moreover, empirical data presented by Eurostat (2024) indicates that the overall waste generated in 2022 in the European Union from all economic and household activities amounted to 2,233 million tons or 4,991 kg per capita. These data indicate that the industrial and logistics sectors are also significant contributors to waste generation. The waste management sector has not been able to respond effectively to the recent rapid and unanticipated growth in the volume of waste (Hossain et al., 2024), mainly due to industrial, logistics and commercial activities. The rapid accumulation of waste is a threat to public health, economic conditions and environmental sustainability. Better waste management is an urgent priority where, if left unmanaged, uncontrolled wastes globally could reach 4 billion tons by 2050. Without effective solutions, problems like rising sea levels and environmental pollution could become worse. It is estimated that by 2025, 0.8 million tons of waste could enter water bodies, which is 30% more than in 2017 (van Leeuwen & Surya, 2024). These risks are transboundary in nature, leading social theorists to call for societal reflection. Against the backdrop of technological and economic development, we must consider the potential negative consequences of progress (Beck et al., 2003).

The rise of various environmental hazards is a paradigm shift in modern society. German sociologist Ulrich Beck referred to this era as the "risk society"—a period in which the process of modernisation necessarily produces recurring and unavoidable risks (Beck, 1992; Jarvis, 2007; Jong, 2022), and Beck (1992) stresses that these risks are not local but universal, affecting all social levels and requiring urgent reflexivity. Modernity is reflexive when society confronts the unintended effects of its own development. This means

that society is not only living through technological and economic development but also critically questioning the negative effects of this development (Beck et al., 2003).

Environmental mitigation is an important response to these risks, and the involvement of government entities and civil society, especially the younger generation, is required, according to scholars. Young people play a crucial role in ensuring sustainability because they are the future custodians of the planet (Ramdani et al., 2024). The younger generation is a potential agent of change in society, but students are often faced with difficulties due to the lack of awareness of the urgency of environmental problems. Research states that the environmental literacy of students is still relatively low (Butar-butar et al., 2025; Hidayati et al., 2023; Maulydazahara, 2023; Onny, 2025). Moreover, the lack of attention to plastic waste has created a stigma on the younger generation as the "waste producing generation". Insufficient knowledge on waste management constrains their capacity to mitigate environmental crises (Rasidi et al., 2020). This means educational institutions should include practical environmental solutions in their teaching to encourage student participation.

In this context, SMAS Maitreyawira Batam, a private institution, has applied a "Waste Bank" system to improve students' awareness of the environment and their management skills. This is evidenced by the school's consistent participation in World Cleanup Day since 2023. It is worth noting that this programme is not limited to the campus environment; in 2024, SMAS Maitreyawira Batam's Waste Bank successfully organised a cleanup activity at Muka Kuning Nature Park in Batam. These activities not only make the students participate in plastic waste management but also serve as their reflective efforts to counter environmental risks.

The literature on environmental reflexivity has expanded, but a major gap persists. Most of the current studies categorize reflexivity into four domains: environmental management (Boström et al., 2017; Pallett & Chilvers, 2013; Wynne, 2002); waste management system (Azliana et al., 2024; Dompak & Simarmata, 2017); governance system that encourages public participation (Dompak & Simarmata, 2017; Mourent et al., 2023); and the role of education in online learning environmental (Kahn et al., 2017). We can also see attempts to promote environmental awareness through programs such as waste banks and ecological schools. Waste banks can be a solution to lessen the impact of plastic waste on the environment by recycling it so that it does not rely on landfills, temporary waste storage sites, waste incineration, and open dumping (van Leeuwen & Surya, 2024). However, the systematic literature review by Wang et al. (2026) stated that the "reuse, reduce and recycle" strategy faced numerous implementation challenges, including sorting difficulties, excessive waste generation, low quality materials, lack of adequate equipment, and lack of incentives in the production process, which pose considerable barriers to the implementation of recycling.

To answer this main question, the study is also based on the following research questions:

1. RQ1: What are the reasons and motivations of SMAS Maitreyawira Batam students in participating in the Waste Bank program?
2. RQ2: How do students respond to the environmental crisis through the Waste Bank program of efforts and actions?

To fill this gap, this study investigates the reflexivity of students at SMAS Maitreyawira Batam to environmental risk in the era of risk society. This is a qualitative study that offers a new perspective on student led mitigation efforts through the Waste Bank mechanism. The results of this study are expected to provide information for policy makers in developing educational programs that effectively integrate reflexivity and environmental action.

## Method

This research utilised a descriptive qualitative research design to delineate students' reflexivity in responding to the environmental crisis at SMAS Maitreyawira Batam. The qualitative approach is appropriate to explore and interpret the meanings constructed by individuals or groups on social and environmental issues. According to Creswell (2016), qualitative research provides a detailed understanding of the perspectives and experiences of participants. Hence, this research aims to describe the background of the students and the various types of reflective actions that they do to deal with the environmental crisis through their involvement in environmental activities.

Data sources used in this study are primary and secondary data. The primary data were collected directly from the research informants, namely students and school stakeholders involved in the Waste Bank program. Data consists of information on the backgrounds of the informants, their perceptions of the environmental crisis, and their explanations of actions as manifestations of reflexivity within the framework of the risk society theory. The collection of secondary data such as academic literature, relevant previous studies, books and institutional reports supported the analysis and interpretation of the research findings.

The participants were deliberately selected to tell about their experience in the Waste Bank program at SMAS Maitreyawira Batam. The selection criteria were: (1) active participation in the Baswira program for at least six months and having a defined structural role and (2) a supervising teacher or facilitator for Waste Bank activities. These criteria are used to ensure that this study can capture the diverse viewpoints of the Waste Bank's operations.

Because the research participants were under 18 years of age, the researcher obtained informed parental consent at the onset of the data collection process. Parents or guardians of the participants signed

informed consent forms. Participants were informed about the objectives of the research, the nature of their participation, the voluntary nature of their participation, the possible risks involved and the right to withdraw from the study at any point without any consequences. In all research outputs, pseudonyms or initials were used to ensure participant anonymity strictly. Raw research data was stored with strong encryption on Google Drive.

Qualitative data were gathered via structured interviews, direct observation, and documentary analysis. Structured interviews were conducted to systematically obtain the views and experiences of informants, whereas observations were employed to examine students' behaviours and participation in the Waste Bank activities. The data were supplemented and validated by documents such as photographs and institutional records. The study emphasizes two key aspects that are the students' backgrounds in participating in the Waste Bank program and the types of efforts made to address the environmental crises. This gives a comprehensive picture of students' reflexivity in the context of environmental challenges. The participants in this study were students aged 15-17 years. Because of this, this research has submitted a research code of ethics and has obtained ethical approval contained in decision No. 4837/KEP-UNISA/IX/2025.

Based on Table 1, the study involved 8 participants, divided into two groups, namely students and teachers who were involved in the waste bank activity at SMAS Maitreyawira Batam. Participants' ages ranged from 17 years (n= 5) to 43 years (n= 1) with 1 participant aged 22 years and 1 participant aged 16 years. The informant, whose initials are KE and FA, is a student at SMAS Maitreyawira Batam who is originally from Palu but has been attending SMAS Maitreyawira Batam since 2023. Informant KE and Infornant FA are also involved in Baswira activities and is thus well-versed in the procedures and conditions in Batam. The full profile is given in Table 1 below.

**Table 1**. Participants research profile

| Informants Initial | Age (y.o) | Role in the waste bank | Sex | Domicile |
|---|---|---|---|---|
| FA | 17 | Chairperson Waste Bank (2024/2025 Term) | Female | Palu |
| SR | 17 | Collection, Weighing, and Sorting Division | Male | Batam |
| CH | 16 | Publication and Public Relations Division | Male | Batam |
| GB | 17 | Publication and Public Relations Division | Male | Batam |
| KE | 17 | Production and Recycling Division | Male | Palu |
| JW | 17 | Publication and Public Relations Division | Female | Batam |

| Informants Initial | Age (y.o) | Role in the waste bank | Sex | Domicile |
|---|---|---|---|---|
| DN | 43 | School teacher | Male | Batam |
| RE | 22 | School teacher | Female | Kerawang |

Following the completion of data collection, the data were analysed using the interactive technique proposed by Miles et al. (2014), which included data condensation, data display, and conclusion drawing. This stage involves selecting, focusing, simplifying, and abstracting raw data from field notes, interviews, or documents into a more concentrated and meaningful form. The results will be presented in the form of narratives, tables, or infographics. Conclusions will then be drawn from the data to produce accurate information. If the data is deemed unsatisfactory, the researcher will repeat the stages from data collection to drawing conclusions. Data collection yielded the themes presented in Table 2 below.

**Table 2**. Data for analysis

| No | Key Findings | Code | Informants Who Mentioned |
|---|---|---|---|
| 1 | Background Motive | Deteriorating environmental conditions | KE and FA (2) |
| | | Environmental Aesthetics | SR, JW, CH, and GB (4) |
| | | Expectations | KE, CH, SR, FA, GB, and JW (6) |
| | | Intergenerational Concerns | KE, GB, FA, SR, CH, and JW (6) |
| | | Participation in the Waste Bank Program | GB, JW, CH, KE, and SR (5) |
| | | The Influence of Lifestyle | CH, SR, KE, and JW (4) |
| | | Fostering Awareness | FA, KE, and JW (3) |
| 2 | Forms of efforts and actions | Waste Collection and Sorting | JW, GB and CH (3) |
| | | Educational Outreach | KE (1) |
| | | Self-Reflection | FA and SR (2) |
| | | Making Eco-Enzymes | CH and SR (2) |
| | | Reducing the Use of Single-Use Items | KE, SR and JW (3) |
| | | Creating Educational Content | CH (1) |
| | | Encouraging Community Participation | FA and JW (2) |

Several strategies for validation were also used in this study to ensure the credibility of data. Then triangulation was done by combining data from interview, observation and documentation. Secondly, member checking was performed by re-verification of initial interpretations with a number of participants to ensure that the research results were consistent with their experiences. Third, the researcher took field notes systematically during the observation process to improve consistency in data analysis. The role of AI (Gemini AI) in this study was confined to language editing for academic standards. The researcher also reviewed the generated information carefully and thoroughly. The researcher did the whole research

including writing, conceptualisation, data collection, literature review and data analysis without any help from AI.

## Results

The researchers found that the students of SMAS Maitreyawira Batam were involved based on the results of field research. Table 3 summarizes the findings. Basically, the students' involvement in Baswira activities was not due to their concern about environmental degradation but was based on their social responsibility as custodians of the Earth, our common home. Moreover, their participation in Baswira activities is a form of pre-empting environmental degradation that endangers the lives of the next generation. Furthermore, the acts done within Baswira activities are intended to have implications on the wider community by way of small-scale empowerment efforts within the student population of the school.

**Table 3**. Research findings

| No | Findings | Description |
|---|---|---|
| 1 | Awakening Awareness | Intergenerational and global concerns have made participants aware of the urgency of the environmental crisis and its impact on future generations. Moreover, they also perceive firsthand the deteriorating aesthetic condition of the Earth (pungent odors and litter scattered everywhere). Consequently, there is a need for a commitment to a clean environment and a sense of moral responsibility. |
| 2 | The Process of Reflexivity or the Role of the Waste Bank | Baswira serves as a space for social learning that facilitates technical environmental education (sorting polymers, fermentation) and an understanding of the environmental crisis. This place also encourages students to take direct action to address issues overlooked by environmental industrial policy. |
| 3 | Types of Actions (Collective and Individual Efforts) | The actions taken include waste collection and sorting (weekly routine), making Eco-Enzyme (further processing), community outreach and education (especially in remote areas), creating digital educational content, reducing the use of single-use items (by using personal water bottles or lunch boxes), and self-reflection. These efforts foster a new sense of solidarity, moving from personal reflection toward shared goals and public action. |

The operational system of the SMAS Maitreyawira Batam Waste Bank is based on a multidimensional environmental mitigation approach which consists of four major activities, namely plastic waste segregation, organic waste processing through eco enzyme production, environmental cleaning activities, and public awareness campaigns. Routine Plastic Waste Management is conducted weekly on Saturdays. The protocol is based on systematic segregation of plastic bottle waste into three specific types of polymers: High Density Polyethylene (HDPE), Polyethylene (PP). Waste Bank processes organic waste by running the eco-enzyme production program for organic waste processing (Eco Enzymes). Members gather organic substrates, primarily fruit peels and vegetable scraps. The materials are treated conventionally with

a ratio of 3 parts organic material, 1 part sugar and 10 parts water. The mixture was then allowed to ferment naturally until the enzyme solution stabilised and ready for use.

Community Engagement and Environmental Education is a school based initiative, the Waste Bank reaches beyond, through external cleanup activities in neglected areas with high levels of waste accumulation in Batam. Such physical interventions are accompanied by educational outreach programs. Members engage with the local community in these events to create awareness about importance of waste management , urgency of ecological crisis and practical ways of recycling both organic and inorganic material. This study identifies several motivational factors behind the student participation in the SMAS Maitreyawira Batam Waste Bank. The participation is mostly driven by a serious concern of the degradation of the local environment and its negative impact on the quality of life. Many respondents also highlighted a sense of generational responsibility, seeing their own engagement not merely as an extracurricular activity but as a moral responsibility for the younger generation to protect environmental sustainability.

The informants highlighted the Waste Bank as an important educational platform and source of deep personal growth in terms of perceived benefits. The students shared experiences of feeling proud when sorting waste or making eco enzymes and learned skills that helped to solve their own environmental problems. Alongside the technical skills, the programme is a place to make new friends, to feel a sense of belonging and to derive satisfaction from making a difference. The participants expressed that participation broadens their social networks, but also nurtures strong empathy towards their peers and towards the fragile world they are trying to protect.

The member strongly agreed on the need for growth as for the future. The overall aim is to increase peer participation to trigger a broader change in environmental consciousness in the school ecosystem. They also hope that their activities, from clean-up and waste sorting to public outreach, will have a positive ripple effect, influencing waste management and awareness in the wider community. The results indicate that SMAS Maitreyawira Batam Waste Bank (Baswira) students' participation is mostly motivated by a reflective consciousness of the "manufactured" risks of modernisation and industrial development. Students rejected the idea of waste as merely a sanitation problem, viewing it instead as a symptom of a larger planetary crisis. Sensory perceptions of this crisis were articulated by informants KE and FA, who asserted that "the environment is not okay," thereby establishing explicit links between rising temperatures and anthropogenic activity. This ties in with the recognition that risks in late modernity are no longer invisible but have become tangible physical realities.

Furthermore, the data shows that these young people are experiencing what can be described as anticipatory disaster. Informant KE demonstrated profound concern regarding the "boomerang effect" of

contemporary environmental neglect on future generations, questioning the viability of conditions for their successors and noting that future environmental management would become significantly more challenging. This sentiment is shared by Informant GB, who sees inaction as "killing the place we live in." The students here have a cosmopolitan consciousness, they know that local indifference has global, irreversible consequences and they are forced to act now against future destruction.

This study indicates a shift in the perceptions of the organization from a functional waste collection unit to a 'sub political' focus. The term 'sub political' is used here to signify a grassroots arena where individuals or groups operate independently on social issues often overlooked by formal political structures. At the beginning, expectations were limited to the technical act of "collecting trash" (Informants KE, CH). But through active engagement the students remade Baswira as a site of institutional reflexivity. GB rebuilt the waste bank as an entity that manages "small programs" that have a substantial social implication. These activities are more than just clean-up activities but include the production of Eco Enzyme (Informants CH, SR) which is a reflexive approach to technology by re-using waste instead of discarding them. As the informant GB states, Baswira provides the youth with an opportunity to "participate in society," stressing the school as a sub political platform. Students dismantle traditional bureaucratic hurdles to directly engage in community risk mitigation through programs like "Clean Up" and outreach to marginalized areas (Informant KE), democratizing environmental responsibility.

The results suggest that students employ "biographical solutions to systemic contradictions" in the face of systemic environmental risks. And their concern about global risks is highly personal, involving real self-reflection and self-monitoring. For informants FA and SR the need for change is not something distant or theoretical, they speak with sincerity: environmental action must begin with "self-awareness" with a tone of determination and hope. This individualisation is expressed in the micro-practices of daily life. For KE, SR and JW, carrying personal containers and rejecting single use plastic is not a chore but an enabling act, a simple gesture that for them reinstates a sense of control in a "uncontrollable world" Each act is a statement: personal choices count. Informant CH's production of digital content to "convince" others is a sincere form of outreach as he hopes his peers will join him on this journey to fight the normalization of environmental loss.

This individualisation is evident in the micro-practices of everyday life. For informants KE, SR, and JW, opting to carry personal containers and refuse single-use plastics was not a chore but an act of agency, simple gestures that for them reclaim a sense of control in a "runaway world." Every action is a statement; personal choices matter. Informant CH's digital content creation to "persuade" was a form of outreach motivated by genuine concern, as he hoped her peers will join her in this journey of defying the normalization of environmental loss.

## Discussion

This research aims to analyze the Environmental Awareness of Students SMAS Maitreyawira who participated in the program Baswira, mainly about the motivations and actions contained in the program. A qualitative descriptive analysis was carried out on the participants who met the established inclusion criteria in order to meet this objective. Our primary results demonstrated that the Baswira programme altered students' perceptions of the environmental crisis from concerns about industrial waste to an understanding of collective moral responsibility. This shift is exemplified by their involvement in waste management activities via the School Waste Bank. These results contribute to the sustainability of the activities of the School Waste Bank, which can contribute to the growth of students' awareness towards the environmental crisis. This awareness is created not only through technical tasks such as sorting and production of eco enzymes but also through emancipatory approaches such as peer education and community outreach. The results of this study align with prior literature; for instance, Munawar et al. (2019) found that environmental education enhances students' capacity to act as responsible stewards. Similarly, Rokhmah (2019) demonstrated that practical application and active participation are essential for instigating behavioural change, an observation mirrored by the action shifts recorded among the current student cohort. Consequently, the present study provides empirical context for the structural paradigms identified by Hossain et al. (2024), who illustrated how geopolitical conflicts or global health pandemics can directly disrupt waste recycling systems in Europe and increase household waste globally. The implication is that environmental literacy must teach students to recognize the links among sectors (health, politics, economics and the environment) so that they see that the local or global can have a ripple effect.

In the next part of this discussion, our research shows that students' environmental reflexivity is not only due to classroom experiences, but also to interactions with peers in the Baswira program. This awareness is nurtured through students' enthusiasm and initiative in activities such as cleanup, plastic sorting, eco enzyme production and promotion of recycling, reduction, reuse and creation of recycled goods. Research by Christley et al. (2025) underline this where they feel reflexivity is a crucial practice to promote individuals to re-evaluate their relationship with the environment and its effects.

These results can be contextualized within the wider research on community-based waste management. Such studies suggest that initiatives like waste banks can play an important role in reducing plastic pollution and increasing community involvement in waste management (van Leeuwen & Surya, 2024). The community-based approach has environmental benefits and also helps build broader social networks for waste management and environmental sustainability.

Findings about Baswira activities also indicate that the Waste Bank initiative will involve

collaboration, which is seen as crucial to strengthen bonds between residents, schools and the community to build relationships, while serving as a means to accelerate waste collection and sorting. The first step of this initiative will be outreach activities that build collaboration bridges that improve the environment and build interpersonal relationships. By working together we can instill a sense of responsibility and reinforce our discipline as a whole. Waste banks can be used to educate the community to be more careful in managing their waste (Asteria et al., 2018).

Students at SMAS Maitreyawira Batam participate in diverse operations, including the synthesis of eco-enzymes from recycled fruit peels and the segregation of waste into organic, inorganic, and alternative residual categories. Collectively, these actions underscore the critical significance of ecological reflexivity and systemic awareness regarding anthropogenic impacts on wider social strata. Reflectivity involves reflecting on assumptions and actions in the situation, and then modifying everyday practices accordingly to what has been learnt (Fook, 1999). This is evident in the future attitude changes among the actors engaged in waste processing and sorting, which are related to the production of eco-friendly enzymes and waste sorting.

Besides, students also participate in activities outside their studies such as environmental campaigns that involve all ages of people, and clean-up efforts in different places such as beaches, villages and other places. This helps to create a collaborative environment with the larger community and develop interpersonal relationships. Once people get involved, they start to see things differently, in regard to themselves and the world around them. This change in perception is more pronounced when people interact with – and especially when they are in conflict with – opposing parties, often state law enforcement agencies (O'Brien, 1998). It creates a sort of reflexivity that takes place unconsciously, and then it changes the way people perceive themselves. This is where the link between these activities and the theory of reflexivity comes in. Public opinions are changing. People are starting to realize the need to take responsibility and act with empathy when it comes to environmental issues. We have to solve these problems soon and protect the environment from the beginning. We have to use the knowledge that we got from these campaigns.

This relationship highlights the alignment between these empirical activities and the theory of reflexivity. As public opinion changes, people begin to realize how important it is to be responsible and act with empathy when dealing with environmental issues. These problems should be tackled in a comprehensive manner, protecting the environment from the outset, using the knowledge acquired in these campaigns. The results of this study support the idea of Ulrich Beck (1992) regarding the transition from a class society to a 'risk society' where the central logic of social distribution is changed from wealth to risk. SMAS Maitreyawira Batam (Baswira) students demonstrated a mature understanding that modern

environmental threats are not external acts of nature, but "manufactured risks" unintended consequences of modernisation and industrial success. The dangers of the Middle Ages were localized, while modern risks are delocalized, global and irreversible, Beck argues.

This theoretical assumption is well reflected in the students' narratives. The observation of "uncontrollable heat" made by informant KE and the concern about habitat destruction expressed by informant SR mark a shift in perspective, where local waste is no longer seen as aesthetic pollution but as a sign of a planetary crisis. The students refer to the intertemporal dimension of the "boomerang effect" where risks generated from present industrial consumption will "come back to bite" producers and their descendants in the future, recognizing that "future generations will surely feel the impact" (informant KE). This awareness among students means that the production of risk has become the main engine of social dynamics, superseding the production of wealth, in a risk society, and has created a universal vulnerability that transcends geographical and social boundaries.

This study demonstrates the reflexive modernisation mechanism described by Beck, a stage in which society confronts the self-destructive potential of its own modernisation process. Baswira program is an institutional response to this confrontation. Data show that student engagement began with a critique of the "disposable culture" produced by capitalist efficiency and evolved into a conscious rejection of modern comforts for the sake of ecological sustainability.

However, reflexivity in this context is not just reactive but epistemic. Beck says that the definition of risk is one of knowledge. A deepening of reflexivity is illustrated by the change of a waste collection unit into an educational centre (Baswira as described by informant KE who teaches seminars on eco-enzymes and plastic typology). Here the organization is the intermediary, converting latent anxiety into expert knowledge. By educating themselves and the wider public, including marginalized groups in remote areas, these students are breaking down the "organized irresponsibility" of the state and the market. Their logic is that in a risk society ignorance is dangerous and knowledge is a precondition for survival. This resonates with the idea that in a risk society individuals have to become 'small scale experts' to cope with everyday dangers.

One important insight from this research is the translation of reflexivity into what Beck calls "sub politics," activism that takes place outside the traditional parliamentary system. Students embrace "biographical solutions to systemic contradictions" in the context of macroinstitutional paralysis for the environmental crisis This is illustrated by the instrumental action described by Informant KE (e.g. using personal tumblers and reducing plastic use). They are not trivial micro practices but the individualisation of responsibility, the self as the primary site of political intervention.

But these results are at odds with the critique that individualisation leads to atomization. The story rather signals an increase in personal reflexivity towards collective aspirations. Informants CH and SR expressed hopes not only for personal piety, but also for structural changes in societal behavior ('the hope that trash will no longer pile up' 'the hope for a more caring society'). This reflects Beck's argument that private reflexivity has to take public forms in the end to be effective. Baswira provides a space of "collective learning and creation", turning personal anxiety into a collective moral project. In organising, educating and socializing risk awareness, students are effectively building a new kind of solidarity based on shared vulnerability, showing that a risk society, while dangerous, also generates new spaces for action and social change. Environmental awareness is an important driver of behavioral change and it also shapes the knowledge to act. However, previous studies reveal that a lot of students do not have this awareness and cannot identify recyclable materials which hinder action. On the other hand, our study found that students at SMAS Maitreyawira Batam had a high level of reflexivity in facing urgent environmental issues. This greater awareness is directly translated into action that bridges the usual gap between knowledge and practice.

Moreover, while Liao and Li (2019) stress the role of environmental education in promoting positive attitudes towards solid waste management, their analysis mainly correlates reflexivity with acquiring information. However, the present study extends this notion by demonstrating that student reflexivity at SMAS Maitreyawira is based on not only received information but also direct experiential knowledge of the surrounding environment. This leads to the important question of whether reflexivity requires action. The work of Liao and Li (2019) has a limitation regarding the depth of the "critical reflexivity" in a longterm institutional context; furthermore, their research did not fully consider institutional accountability and the profound impact of reflexivity on sustainable behavior. By contrast, the Waste Bank program at SMAS Maitreyawira offers a structured framework which routinely reinforces knowledge and experience. This builds a moral imperative that goes beyond mere knowledge, supported by partnership and institutional facilities such as the World Cleanup Day initiatives. Reflexivity has been discussed in previous research, but often with little regard to its long-term implementation. We seek to contribute to this discussion by highlighting the importance of ongoing institutional support.

One of the persistent issues in environmental psychology is the "intention behavior gap" Liao and Li (2019) acknowledge that their study mainly focuses on the intention to sort waste, not the actual behavior, recognizing that collective barriers and lack of facilities often prevent the realization of these intentions. This highlights a gap where knowledge and attitudes affect intentions, but intentions do not always translate into action. However, the current research challenges this trend as the reflexivity built through the Waste Bank bridging this gap successfully. Student engagement goes beyond intentions to actual mitigation

actions, even in their daily lives outside the school walls. The school collaborative ecosystem plays a significant role in facilitating this transition, particularly with external partners like PT Free The Sea. Some of the routine activities that are a concrete expression of this reflexivity are cleanup activities and eco enzyme making. It is a proof that with the right support system, intentions can be translated into regular practices. In brief, the picture painted by earlier research is patchy: there may be high awareness and low reflexivity, or high reflexivity and little action, often because of the lack of structural components. These disjointed components are obstacles to the effective mitigation of the environmental crisis. However, the case of SMAS Maitreyawira Batam provides a contrasting story. Here, high levels of awareness are evoked by the surrounding environment. The Waste Bank serves as a "transformative arena" where awareness, reflexivity and action are integrated in a holistic way. This indicates that when educational institutions support a holistic support system, environmental engagement moves beyond performative participation to a true, internalized commitment to the environmental crisis in everyday life. In addition, the results of this study provide information about inclusive types of waste management, such as the integration of sustainable environmental education into extracurricular activities.

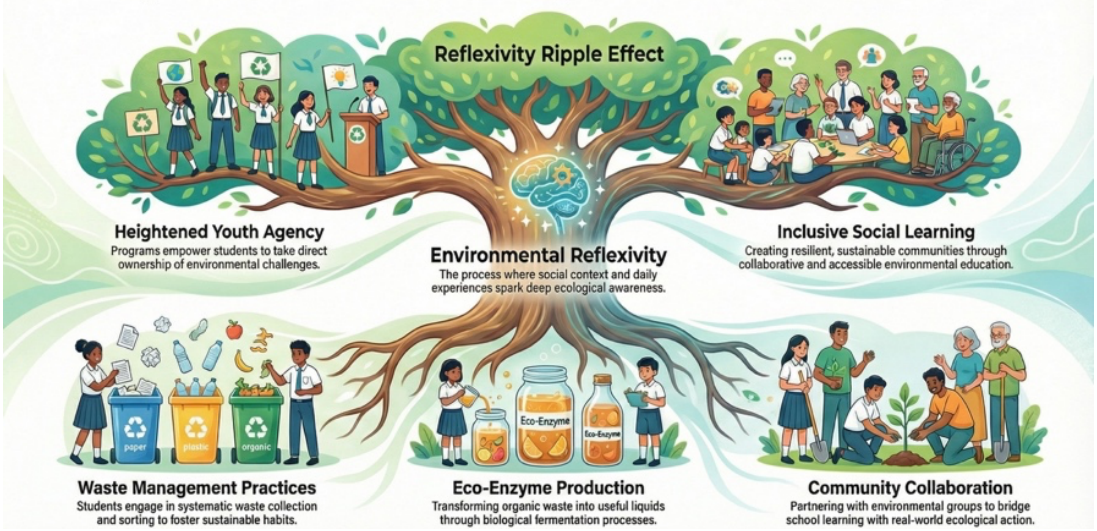


**Figure 1**. Ecological reflexivity

Figure 1 depicts various forms of student engagement at SMAS Maitreyawira Batam, as demonstrated through activities organised by Baswira. As active agents, students tackle environmental issues through collective action within youth organisations rather than addressing them individually. These initiatives encompass diverse activities, including waste management practices for various waste types, eco-friendly production, community collaboration, and inclusive social learning. Such forms of reflexivity operationalise risk society theory, whereby students recognise the urgency of the environmental crisis and address it through active participation in the Baswira community.

## Conclusion

These findings also indicate that the Waste Bank serves as an effective educational space for transforming environmental awareness into reflective action. Through structured environmental activities and learning processes, students can internalize environmental risks and respond to them in practical and sustainable ways. In the context of risk society theory, this study demonstrates that reflexivity can develop at the school level, positioning students as active agents in addressing environmental crises, rather than merely passive recipients of environmental education.

Based on the conclusions, several recommendations can be proposed. First, schools should formally integrate environmental programs such as the Waste Bank into school policies and core learning activities. This integration includes the production of eco enzymes, waste sorting, waste recycling, and cross curricular environmental education (e.g., in sociology, biology, chemistry, and economics), while encouraging interdisciplinary collaboration. Second, schools should organize periodic environmental campaigns and challenges involving students and parents, such as using reusable water bottles, bringing lunchboxes, and processing household organic waste, with the Waste Bank as the focal point. Third, students are encouraged to extend environmentally responsible behaviors from school to their families and communities. Fourth, education stakeholders and policymakers should actively support school-based environmental initiatives as a strategy to foster environmental awareness and collective responsibility from an early age. This support may include providing incentives or resources for recycling facilities and facilitating partnerships between the Waste Bank and environmental institutions, including nongovernmental organizations, at the regional and global levels. Finally, future research should examine similar programs in various education contexts to assess the development of students' reflexivity in responding to environmental challenges.

## Acknowledgements

The authors would like to express their sincere gratitude to Mr. Martinus Danang Pamungkas, their academic advisor, for his guidance, support, and valuable feedback throughout the research process. The authors also thank SMAS Maitreyawira Batam for granting permission and providing the facilities and institutional support necessary for the conduct of this research, as well as all school stakeholders who facilitated the research activities and the implementation of the Waste Bank (Baswira) program. We also extend our gratitude to all student participants who willingly shared their experiences and perspectives, thereby significantly enhancing the quality of the data collected.

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## Conflict of interest

All authors declare that they have no conflicts of interest.

## Data availability

Requests for access to research data may be submitted by contacting the author and providing a clear explanation.

## Funding info

This research received no external funding.

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