Students' Perceptions and Attitudes in Waste Management: The Role of Internet Literacy and Sustainability Programs

Teddy Prasetiawan and Aryo Wasisto
Research Center of Parliamentary Expertise Agency
of the Indonesian House of Representatives, Bandung, Indonesia
teddy@dpr.go.id; aryo.wasisto@dpr.go.id

Abstract

Education about waste in schools plays a significant role in increasing students' perceptions of the environment. Previous research has suggested that students' perceptions in waste management can positively impact future generations' preparation as agents that drive changes in attitude and behavior in society. This study proposes to measure the link between facilities aspects such as internet literacy, sustainability school programs, and integrated studies of the importance of waste management and concern of waste. Then we placed the volunteer attitude variable as an endogenous variable. The respondents were 293 students from private schools in South Jakarta and its surroundings. Data samples were collected during the COVID-19 pandemic, making it possible to have low perception and attitude values. Using SEM analysis, we found that school programs showed the most substantial and significant effect among the other variables to explain students' importance of waste management perception (t-statistic = 4.221). This study illustrates that all variables in the facility's aspect can increase the attitude in a more specific context. Our experiment on the facilitation aspect did not have a significant effect on volunteer attitudes. Still, it was closely related to perceptions, thus concluding the importance of these three aspects of their schools' implementation. Therefore, testing a model that has met the statistical requirements requires a broader and more varied sample.

Keywords
Environmental education, importance of waste management, SEM analysis, student's attitude, student's behavior

1. Introduction

Researchers have proven the importance of environmental awareness as an agent for planning a green society. Environmental education's success in a country is an immense contribution to every government effort to aspire to a national-scale sustainability program (Boumedyen Shannaq*, 2013; Phan Hoang & Kato, 2016). One of the significant parts of the educational goals is how the change in students' perceptions of environmental issues changes to attitudes and then increases to the behavior stage (Boca & Saraçli, 2019). Environmental education is vital to raise awareness. Since its inception, environmental education has struggled to find a place in the school curriculum. Science lessons link environmental education with science lessons as a holistic integration (Gough, 2016).

One of the environmental issues that continue to be discussed in Indonesia is waste management. Students in Indonesia, especially in Jakarta, have had repeated experiences of how waste becomes a problem as part of the cause of flooding and disease, which then spreads to other complex issues. It is essential to measure the extent to which students in Jakarta perceive waste in the framework of environmental education, especially in the COVID-19 pandemic situation.

In Indonesia, environmental education development in schools has been integrated either totally or partially into character education. The schedule for cleaning pickets, extra-curricular activities, cleaning the trash together, and community service driven by the principal are examples of various activities closely related to efforts to increase student knowledge and perceptions.
Unlike previous studies, who focus on higher education (Lee & Efird, 2014), we try to adopt Boca and Saracli's (2019) latest environmental education research into a more specific concept. We try to contextualize environmental issues into waste management because of respondents' considerations. Path analysis where perception can increase attitude and then attitude can increase behavior level is a fascinating discussion for Indonesia's context. Meanwhile, in this

article, we decided to use two paths: the perception variable as a mediator between the facility and attitude variables. Therefore, we offer the facility variable as a new based on direct observations in the field. This study's focus shifts backward, namely that we suspect that the facility factor increases students' perceptions of the waste issue.

1.1 Objectives

Reflecting on the importance of the younger generation in awareness of waste and the environment, this study seeks to answer the conceptual relationship shown in Figure 1. We focus on two stages, namely integrated studies (IS), internet literacy (IL), and sustainability programs that can influence students perceptions in the context of Important of waste management (IMW) and concern about waste (CW). We also directly linked IS, IL, and SP to have an influence on volunteer attitudes (V).

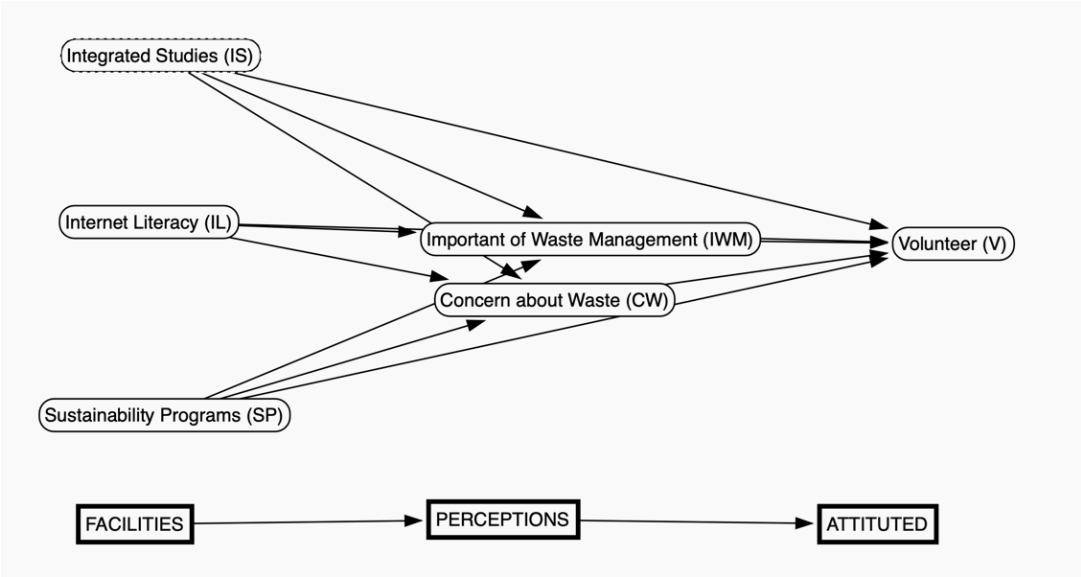

Figure 1. Research model adapted from (Boca & Saraçli, 2019)

We include IS, IL, and SP as supporting aspects for students' perceptions as modality factors. These three variables are closely related to the school modality of education services that students directly experience. Meanwhile, IMW and CW are part of the perceptions resulting from the facilities programmed by the school. Perceptions of IMW and CW are essential to be seen as the school's goal in increasing the attitude level in the form of volunteers.

2. Literature Review

An integrated approach also provides benefits on how one's attitude toward acting in society (Staniskis & Stasiskiene, 2006). Tudor (2014) explained the importance of combining traditional and modern methods in order to increase effectiveness in the teaching and learning process. The obligation to integrate environmental education into the curriculum increases the perceptual effect on teacher learning methods and classroom strategies (Kelani, 2015). Environmental education, which is integrated into multiple intelligence, incredibly communicative English, can effectively change students' perceptions and how they perceive their environment (Sangsongfa & Rawang, 2016).

The advantages of integrated learning in environmental topics in schools have allowed students to explore more of the two methodologies offered in regular classes. Two parallel and mutually supportive methodologies determine the direction of effective learning. Failures in this lesson concept are usually due to the lack of preparation and inadequate planning, both in-process and output. Focus can be biased if two teachers cannot articulate the fusion of the core concept of the subject. The ultimate goal of environmental education can be used as an effort to manage environmental resources. The features of environmental education are interdisciplinary and the ability to deal with environmental problems, and the fact that environmental education is flexible to be applied in a variety of contexts (Filho, 1997).

One of the features of the campaign on waste and the environment using the internet media is its high accessibility to the wider community. The content shows reality through visuals and audio-visuals, making it easier for Instagram, Twitter, and Facebook users to experience empathy firsthand. More advanced, good use of media and literacy skills can promote positive progress on mitigation topics (Campbell, Kotcher, Maibach, Rosenthal, & Leiserowitz, 2021). It argues that media exposure on specific topics generally encourages citizens to understand the factors that drive environmental damage and global warming-related to the evaluation trend of politics in a country. Environmental issues are of relative importance compared to other issues in building public and political will for climate action (Leiserowitz, 2019)

Good digital literacy encourages students to gain experience in obtaining information effectively. Internet literacy raises students' background knowledge, which encourages students to learn to synthesize information for new knowledge and share information with others (Ilomäki, Taalas, & Lakkala, 2012). Students gain experience to build their competencies and develop correct attitudes and perspectives (Tang & Chaw, 2015). Severo et.al (2019), related to digital social networks, also found a greater chance of successfully making awareness, both social and environmental if the public has integrated information about these issues.

In the concept of green learning, there are external factors that cause the effectiveness of learning about the environment requires the commitment of all elements in a holistic unity: Shannaq (2013) connects the green learning program with student performance in schools. A study revealed the importance of sustainability school in striving to build communities that are aware of the environment. This study also found that schools with sustainability designs have a positive impact on the quality of education (Gough, 2005)

Boca and Saracli (Boca & Saraçli, 2019) developed an analytical model of students' perceptions and attitudes, which then significantly affected the behavior level in an environmental context. His research shows that the perception variable plays an essential role in the success of an environmental-themed school program. The relationship between perceptions of the importance of environment and the concern of environment gives positive results on volunteers' attitude. Then the volunteer variable also has a significant effect on reuse behavior. In this context, we assumed that the volunteer variable could be used as a reference to explain the achievements of environmental education. The attitude of volunteerism plays an important role in influencing the ultimate goal of environmental education. Environmental education aims to change students' behavior in very usable forms such as recycling waste, sorting waste and using waste in the form of work. Meanwhile, volunteerism is a voluntary feeling that arises from the experience of empathy and comprehensive education.

Perceptions of the importance of management in waste management are students' statements regarding their belief in the potential for environmental damage in the future. Concern about environmental issues in perception is an attitude that consists of an idea of the bad effects caused by daily habits such as littering. This attitude is shown by testing their level of empathy by presenting content close to them. Therefore, the higher the level of students' understanding of environmental issues, the potential to increase their perception of the importance of environmental management.

3. Method

We use quantitative methods to get relevant results with the previous study. We consider and choose Partial Least Squares Structural Equation Modeling (PLS-SEM) to predict the relationship between latent factors and volunteer attitude. Figure 1 illustrates the direct and indirect relationship between facility aspects and attitude aspect through the perception aspects. The facility aspect consists of three independent variables: IS, IL, SP, which are expected to influence the IWM and CW levels. The main research line adopted the Boca and Saracli (Boca & Saraçli, 2019) model, where the level of perception, especially the concern of the enviroment, strongly influenced the volunteer variable. Each question that is a factor uses a Likert scale-type with a range of 1 = disagree to 5 = totally agree.

According to literature review, we offer eleven main hypotheses:

H1 : Students who take integrated lessons on environmental education have a significant effect on volunteer attitudes

H2 : Students with strong Internet literacy have a significant effect on volunteer attitudes

H3 : Students who take part in a particular program on sustainability at their school have a strong relationship with volunteer attitudes

H4 : Students who take integrated lessons about environmental education have a significant effect pm their perception of the importance of waste
H5 : Students with strong internet Literacy have a significant effect on their perceptions of the importance of waste management
H6 : Students who participate in a particular program on sustainability at their school have a significant effect on students' perceptions of the importance of waste management
H7 : Students who take integrated lessons about environmental education have a significant relationship with their perceptions of concern about waste
H8 : Students with strong internet literacy have a significant effect on their perceptions of concern about waste
H9 : Students who take a particular program on sustainability at their school have a strong relationship with students' perceptions about concern about waste
H10 : Students' perceptions of the Important of Waste Management have a significant effect on volunteer attitudes
H11 : Students' perceptions of concern about waste have a significant effect on volunteer attitude

3.1. Validity and Reliability

Table 1 shows the construct validity and reliability in this study which the Cronbach's Alpha (CA) and Average Variance Extracted (AVE) values indicate. the Construct Reliability (CR) value gets satisfactory results because it is above 0.70. The AVE column with a limit value also meets the lowest threshold, namely the requirement of 0.50 (Hair, Sarstedt, Hopkins, & Kuppelwieser, 2014).

Table 1. Construct Reliability and Validity

Construct	Cronbach's Alpha (CA)	Composite Reliability (CR)	Average Variance Extracted (AVE)
Integrated Studies	0.894	0.932	0.802
Sustainability Programs (SP)	0.708	0.813	0.691
Internet Literacy (IL)	0.766	0.867	0.687
Importance of Waste Management (IWM)	0.732	0.824	0.545
Concern about Waste (CW)	0.852	0.901	0.546
Volunteer (V)	0.764	0.854	0.606

4. Data Collection

Respondents in this study were students in grades 11 and 12 from private schools with added curriculum education in South Jakarta and its surroundings. A total of c from 9 selected schools participated in an online survey coordinated by their teachers. Selected private schools are schools with relatively high monthly fees in the Jakarta area. We also assume that schools with reputable blended curricula liberally implement facilitated environmental education. Questions sheet links are sent by correspondent teachers using What's App Group to make the returning answers more effective. The choice of location in Jakarta is considering the level of internet literacy and their parents' purchasing capacity. The data collection was carried out from February 4 to February 28, 2021. The context in that time frame was learning through the internet because it was still in a COVID-19 pandemic situation.

5. Results and Discussion

5.1. Factors, Loading Factor and Outer Loading

This study's statistical test is the outer loading listed in table 2, which is the magnitude of the correlation between indicators and latent variables. The loading factor value must be greater than 0.7 to fit into the valid criteria. After removing the problematic indicators, we get increasing importance.
Table 2 shows the integration lesson between science and environmental education, which has the highest loading value. This influence is because 73% of the respondents are 12 and 11 graders who have chosen their focus science major. Conceptually, IS1 shows that science and knowledge can trigger respondents' understanding of waste

management benefits. Meanwhile, religious studies (IS2) show fewer role relations in the topic of waste management. The argument that can explain this is that religious lessons are not a core subject in schools with an international curriculum compared to science subjects.

The SP indicator in the study also illustrates the school's ability to convince students with school programs such as community service. Students are directly in a study tour situation that combines theory and reality. The key to a successful series of school programs is student happiness and comfort. More advanced, creative schools in combining environmental education with the concept of sustainability. For example, by taking advantage of music shows, speeches, and inviting their idols to an event with environmental sustainability. Table 2 also shows SP2 gets the highest loading value (0.98). We assume that those indicators is crucial to explain the consistency of the SP variable. Schools that adopt SDG values have selected a coordinator among their teachers capable of carrying out this mission. Most of them are very disciplined in enforcing regulations related to waste and cultivating a passion for the environment.

In the IL variable, we get IL1 which has the highest loading value because the use of the internet is necessary for students and teachers in the learning process or planning school programs. They often access news, look for pictures and videos related to the phenomenon of climate change and marine debris. The CW variable, which indicates students' perceptions of their environment, shows that all indicators are above 0.7. This figure ensures that the CW variable is suitable for being a latent variable.

Table 2. Indicators and Outer Loading Score

Factors	**Indicators**	**Loading**
Integrated Studies (IS)	Science lessons gave me excellent knowledge about the benefits of waste management. (IS.1)	0.92
	Religious lessons helped me understand the importance of environmental issues. (IS.2)	0.51
	Social science lessons gave me knowledge about the benefits of waste management. (IS.3)	0.70
Sustainability Programs (SP)	My school has an exciting program on waste management and the environment (SP1.)	0.80
	My school is concerned with environmental issues (SP.2)	0.98
	My school involved me in caring about programs about the environment and waste (SP.3)	0.72
Internet Literacy	Using the Internet, I understand the world's environmental problems. (IL.1)	0.97
	Using social media, I observe environmental issues are very urgent. (IL.2)	0.86
	Social media brings me to meet with people who care about waste and environmental damage. (IL.3)	0.71
Importance of Waste Management (IWM)	I believe environmental issues are mattering. (IMW.1)	0.73
	I believe waste affects the environment. (IMW.2)	0.78
	I have serious concerns about issues like waste shorting. (IMW.3)	0.70
	I have serious concerns about waste issues like water and marine pollution. (IMW.4)	0.67
Concern about Waste (CW)	I am concerned about the effects of waste mismanagement on me. (CW.1)	0.79
	I am concerned about the impact of littering on me (CW2)	0.91
	It annoys me to see someone litters. (CW3)	0.84
	I am anxious that environmental waste will make the world an unlivable place. (CW4)	0.81
Volunteer	I will volunteer to clean up trash in the family and school environment. (V1)	0.78
	I will take part in the ward activities my school holds. (V2)	0.88
	I will take part in the environmental cleanup campaign. (V3)	0.88
	I will sort the waste products that are consumed for recycling. (V4)	0.56

In variable V, we get that the loading value is V4 which is 0.56. This result is the lowest. We believe that recycling has not occurred significantly and simultaneously as a dominant attitude among grade 11 and 12 students. Meanwhile, students will be willing if their school becomes the guide for volunteer activities. They also do not mind if they jointly carry out environmental cleanliness campaigns. V2 and V3 in table 2 describe the strength of the will of students in participating in environmental programs held by schools. These two indicators illustrate the excellent relationship between schools and students. Schools are in charge of programs, including waste management and education. The relationship between the program and students is tied to the goals of the curriculum in achieving environmental

education goals. This condition illustrates that students are comfortable with environmental programs that are routinely held at school. Private schools with extra-curricula seek to improve services by reducing risks and increasing student satisfaction levels. The volunteer attitude shows volunteerism which describes happiness and obedience in the school environment.

This study seeks to identify the relationship between facility variables in influencing private school students' attitude level in South Jakarta. We propose a path model to draw the relationship between the two variables; the perception variable is the mediation. Therefore, after we validated each variable, we tested the model's strength and significance relationship at the structural testing stage.

5.2. R Square and P-Value

R^2 is used to measure how much influence exogenous variables have on endogenous variables as a model. The greater the R^2 value, the better it is used as a research model. Testing R^2 in this study resulted that the exogenous variables IS, SP, IP to the endogenous variable IMW resulted in a value of 43%, and the CW variable was 19%. Meanwhile, testing the second R2 of the exogenous variables IMW and CW on the V variable was 57%. This value is lower than 60 percent because we suspect that other exogenous variables can increase students' perceptions of the concern of waste, the importance of waste management, and voluntary attitudes.

We argue that the low R^2 score in this study is reasonable because the phenomenon of volunteerism among students is difficult to understand clearly (Benitez, Henseler, Castillo, & Schuberth, 2020). We suspect that variables such as the intensity of climate change on discussion, family habits, empathy value, and activity in communicating with non-governmental organizations have the potential to determine the high value of R^2. Meanwhile, previous studies about perception variables and attitude have measured variables that are not present in this study, such as warning attitude and culture environment as endogenous variables (Boca & Saraçli, 2019).

Significant effects between variables are indicated by using a two-sided t-test with a *p-value* of 5% significance level. This path coefficient simultaneously produces a significant value if the T-statistic is greater than 1.96 (Wong, 2013). Table 3 explains that not all exogenous variables in this study significantly affect volunteer attitude in testing the hypothesis.

Volunteerism activities among students in private schools in South Jakarta is a combination of a desire to participate in a school program and a suggestion of their reading experience. Integrated studies in this study do not have a significant effect on shaping their volunteer attitude. Even IS also had no significant impact on IMW and CW. We assume that students perceive regular subjects differently than they enjoy school programs separate from the formal assessment. We suspect that students favor doing practical environmental activities so that their real experiences encourage perception and empathy. In interviews with several teachers, we found that ecological study integrated into regular subjects was only a theme but did not bring students into the experience inside reality.

IS did not significantly affect CW and IMW due to weak readiness in the aspects of the teaching force and school programs. In order to achieve good integrated learning and fun for students, good preparation by some teachers is the main feature. Sometimes, combining two subject matters in class cannot be measured well and takes more time. Failed integration usually makes students confused in achieving learning goals. The problem often found is that students tend to get bored quickly in a regular class with the same conditions. Teachers also find it difficult to make assessments. The integrated learning tends to focus on administrative fulfillment rather than the idea of teaching and learning activities. Therefore, the perception of CW is more potential when students are in reality and listen to direct exposure from experts. Creative and attractive program packaging is also an essential factor to enhance students' desire to participate in environmental sustainability-related events.

Table 3. Hypothesis analysis of T-Statistic and P-Value

H	Hypotheses	Original Sample (O)	Sample Mean (M)	Standard Deviation (SD)	T-statistic	P-value	Result
H1	IS → V	0.084	0.080	0.045	1.081	0.062	NC
H2	SP→V	0.129	0.135	0.045	1.392	0.062	NC
H3	IL→ V	0.076	0.066	0.017	0.761	0.464	NC
H4	IS→ IMW	0.075	0.071	0.048	1.509	0.114	NC
H5	IL→ IMW	0.605	0.509	0.124	2.504	0.010	C
H6	SP→ IMW	0.311	0.501	0.101	4.221	0.019	C
H7	IS→ CW	0.071	0.068	0.04	1.023	0.761	NC
H8	SP→ CW	0.389	0.380	0.166	2.344	0.011	C
H9	IL→ CW	0.233	0.433	0.433	0.189	0.081	NC
H10	IMW→ V	0.254	0.261	0.128	1.987	0.050	C
H11	CW→ V	0.481	0.405	0.122	3.229	0.001	C

Note: NC= not confirmed

Sustainability programs do not have a significant effect on volunteer attitude but impact IMW and CW. Since IMW and CW are mediators and significantly impact the volunteer attitude variable, we consider the variable SP possible in the model.

From the results of the significance of SP→IMW and CW, we believe that the program outside the regular section and schools' ability to implement SDG-related character education appears to increase the exciting experience for students. This reason is related to the fact that students will better understand content when in real situations rather than just listening to it (Tascı, 2015). School schools with global curriculum standards adopt several educational challenges raised by the United Nations. These principles and paradigms have the characteristic that environmental problems are critical for the future of humankind and are threatened by behavior that endangers nature. To that end, education for sustainable development is a lifelong and lifelong effort that challenges individuals, institutions, and society to see tomorrow as a shared day (Gough, 2016). Similar schools in Indonesia seek this principle to motivate students to respect the natural heritage that can be accepted in Indonesia. The principle of a sustainable environment carefully combines elements of Indonesian and global ethics to understand environmental issues. Supporting facilities are a determining factor for the goals of environmental education in schools, increasing students' perceptions of the environment.

We also observe that waste is the closest problem to the students because they are part of waste producers. They are even able to connect the issue of climate change to real conditions. Environmental and education researchers have concluded that education activities such as visits to recycling localities can lead to thematic and social interactions (Asmatulu & Asmatulu, 2011). Schools with relatively high costs have the flexibility to make infrastructure more attractive to raise awareness about waste. With high costs, school cleaners always support on standby to provide comfort at school. Schools regulate behavior with agreed and written rules in the form of sanctions for violations. This condition plays a role in increasing discipline. Learning outside the classroom serves as a "feeling laboratory," which shows actual conditions to open students' feelings of empathy. On the other hand, internet access and school programs initiated by students' ideas are factors that can increase respondents' perceptions of IMW. Schools that are serious about environmental programs hold programs that involve public figures or related NGOs.

The internet literacy variable does not significantly affect V, but it does affect the IMW and CW variables. The IL variable has reminded us that teachers and students are an inseparable part of digital learning. The internet is a resource for students and teachers in education today. The function of the internet has almost replaced the textbooks used in the classroom. The mean value = 5 on the SP2 indicator (based on the experiment question. We also assume the cell phones connected to the internet also motivate them to understand public figures concerned with environmental issues. This research is in line with Leiserowitz (2019) that the principle of the effectiveness of consuming information from social media. Public figures and NGOs' promotion of environmental sustainability and waste has stimulated students' perceptions of CW and IMW. The Internet offers global content that motivates students to seek answers to projects

given by schools. Students' literacy towards environmental news triggers a critical thinking attitude towards realities close to their environment. They have the potential to realize that sustainability for a healthy environment is critical.

The significant relationship between CW and V was the strongest in this study. We think that students with serious concerns about the problem of waste can do volunteer activities because students at the perceptual stage already have high information and habits about their perspective on their environment. Campaigning and getting involved directly with the community do not seem to be a problem as long as the school still protects them. These attachments can be traced since the outer loading sort. CW focuses on topics that are self-efficacy on the behavior of others. Towards other people, respondents feel challenged to do better. For example, the attitude of people who litter is a behavior that goes against the respondent's principles. Respondents reflect on these inappropriate attitudes with a desire to do better.

Because this research was conducted during the COVID-19 pandemic, we had a fundamental change in attitude. However, volunteer attitudes can be formed through refraction and repetitive activities, which involve supervision, both independently and from those in charge. Online school's most challenging dilemma may be the difficulty of adopting a consistent attitude. On the other hand, distance learning can increase high internet usage so that students can explore students' knowledge of waste issues.

6. Conclusion

After passing the validity, outer loading, and reliability testing, the model we propose in the study is suitable for measuring volunteers' variable attitude with IWM and CW as mediators. We offer three new exogenous variables: IS, IL, and SP as factors affecting V, but the results from direct testing are not significant. However, the second test can show that the facilitation aspect can significantly affect the perception of being a mediator. We note the importance of IL, which can be consistently used as a model for measuring V.

Grade 11 and 12 students in South Jakarta have great potential to have a caring attitude towards waste issues. They get education about waste management in schools and participate in environmental programs with global themes. This research has offered the importance of a more attractive integrated environmental education curriculum concept.

This study emphasizes the importance of attractive school program variables and internet literacy as drivers of their students' perceptions of the waste issue. The school program aspect focuses on school authorities in making exciting programs, and internet literacy is largely determined by the ability of students to read news or content on environmental issues on social media. Students are interested in these two things because of the level of exploration open to students and not tied to regular lessons, which tend to be standard. Students' understanding of waste touches more on ethical aspects. The results of the p-value test showed that there was a continuity between the level of perception and attitude.

The study's weakness is that with respondents concentrating on reputable private schools, we are less aware of public schools' exact comparisons. Therefore, future studies may consider more diverse respondents with additional variables such as discussion and more complex technological facilities to explain the variations of IWM and CW. Subsequent research can also complement the participation aspect of attitude variables.

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Biographies

Teddy Prasetiawan is an environmental policy researcher at the Research Center of Parliamentary Expertise Agency of the Indonesian House of Representatives. Mr. Prasetiawan earned Bachelor and Master's degree in Environmental Engineering from Bandung Institute of Technology, Indonesia. He has published journals, part of the books and conference papers. For the past 10 years, he has been supporting the Indonesian House of Representatives on drafting

the law related to environment issue, such as: Law No. 18/2013 on Prevention and Eradication of Forest Destruction, Law No. 37/2014 on the Soil and Water Conservation, Law No. 17/2019 on Water Resources and several laws that are still on going. His research interests include climate change, waste and hazardous waste management, water resource management and renewable energy.

Aryo Wasisto is a researcher at the Research Center of Parliamentary Expertise Agency of the Indonesian House of Representatives. His current expertise are social behavior, voting behavior, political science, election and methodological research.