



# Understanding The Dependency Between Environmental Intelligence, Environmental Knowledge, Environmental Attitudes, and Environmental Behaviour

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**Abstract.** The environment has become an important issue constantly advocated to mitigate the climate crisis. One institution capable of realizing this is universities, where students become agents of environmental change. Universities are required to have programs that support environmental issues. However, the promoted programs may not reach their full potential due to lack of full support from students. It can be interpreted that the success of university programs depends on the environmental behaviour of its students. This research aims to explore the dimensions of dependency between environmental intelligence, environmental knowledge, environmental attitudes, and environmental behaviour among students. By using an exploratory quantitative approach and the main theory of Planned Behaviour, this study examines the psychological factors influencing student environmental behaviour. The importance of this understanding lies in the role of students as agents of environmental change and the responsibility of universities in shaping sustainable thinking and behaviour. This research involves students from the top five universities in Central Java, with a sample of 385 respondents selected randomly. The results of this research are expected to provide deep insights into the relationship between environmental intelligence, environmental knowledge, environmental attitudes, and environmental behaviour. Thus, this research contributes to the development of holistic and sustainable environmental education programs in universities.

**Keywords:** Environmental Change, Environmental Behavior, Sustainable Thinking And Behaviour

## 1 Introduction

The issue of environmental behavior in higher education has become an increasingly urgent focus in recent decades, given the important role of higher education institutions in shaping sustainable environmental behavior and policies. Colleges not only serve as centers for education and research but also as models in the application of environmentally friendly practices. However, efforts to integrate sustainable environmental behavior into campus life are often faced with a range of complex challenges, ranging from a lack of student awareness and participation to limited infrastructure and funding[1]. In this context, research on environmental behavior in higher education is crucial to

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understand the factors that affect environmental behavior and identify effective strategies to overcome it.

Environmental behavior can be defined as individual actions aimed at minimizing negative impacts on the environment. Environmental behavior is influenced by a variety of factors, including environmental knowledge, attitudes, values, social norms, as well as situational and personal barriers[2]–[4]. In college, this behavior can include a variety of actions, such as reducing energy use, managing competitions, using sustainable transportation, and participating in campus environmental programs. Previous research has revealed that environmental knowledge is not always directly proportional to proactive environmental behavior. Although students have adequate knowledge of environmental issues, this does not always translate into real action in the absence of intrinsic motivation and structural support[5]. Study at a university in China shows that although 80% of students are aware of the importance of recycling, only 50% are actively involved in campus recycling programs[6]. This indicates a gap between awareness and action, often caused by a lack of adequate recycling facilities and supportive campus policies.

In addition, the literature also shows that campus social and cultural norms play an important role in shaping students' environmental behavior. According to Lange, individuals tend to follow behaviors that are considered the norm in their social group[7]. In college, these norms can be influenced by campus policies, environmental initiatives, as well as examples shown by staff and faculty. Data from various universities also show that well-designed educational programs and environmental awareness campaigns can have a significant impact on student behavior. Such as the "Eco-Challenge" program at the university in Mauritius succeeded in reducing campus energy consumption by 15% and increasing student participation in waste management programs by 60%[8]. The program not only provides information but also engages students in practical activities that reinforce their commitment to environmentally friendly practices.

In Indonesia, there is an environmental assessment for universities, especially universities that have applied for themselves as environmentally friendly universities. The UI Green-metrics assessment assesses that universities are not only physically qualified for environmental standards, but also regarding the behavior of staff and students such as awareness in disposing of waste in its place and sorting. In addition, the assessment also includes the curriculum in higher education. The curriculum used must be able to teach related to the environment so that it can increase the knowledge index and environmental awareness for students. There are at least 5 universities in Central Java and Yogyakarta that participated in the assessment in the hope that universities have good environmental standards so that they can support government programs related to sustainability. However, this assessment is only an instrument, there is no follow-up or evaluation if shortcomings are found in it[9], [10]. In addition, in practice, universities that are included in UI Green-metrics still have many records related to their environmentally friendly behavior, both by staff and students[11].

The relationship between environmental intelligence, environmental knowledge, environmental attitudes, and environmental behavior is an important topic related to environmental behavior, especially around universities. Environmental intelligence, which includes the ability to critically understand and analyze environmental issues as

well as make sustainable decisions, is often based on a strong foundation of environmental knowledge. Environmental intelligence involves ecological awareness and environmental literacy that allows individuals to recognize the impact of their actions on ecosystems[12]–[14]. Research Mahardika found that individuals with high levels of environmental intelligence tended to have more in-depth and comprehensive environmental knowledge[15]. Data from previous studies showed that 75% of respondents who had high environmental intelligence also showed a high level of environmental knowledge compared to 40% of those with low environmental intelligence. This indicates that increased environmental intelligence can significantly contribute to increased environmental knowledge, which in turn can encourage more environmentally friendly behaviours.

Environmental intelligence involves the ability of individuals to understand, assess, and respond to environmental information in a thoughtful and sustainable way, which then influences their attitudes toward environmental protection and preservation. Environmental intelligence includes ecological awareness and systemic thinking that can increase empathy for nature and encourage pro-environmental attitudes[16]. Individuals with high levels of environmental intelligence tend to show a more positive and proactive attitude towards the environment[17]. As many as 80% of people with high environmental intelligence have a very positive attitude compared to 45% of people with low environmental intelligence[18], [19]. It highlights the importance of developing educational programs that not only increase environmental knowledge but also hone environmental intelligence to foster a more positive attitude and a stronger commitment to environmentally friendly actions.

Environmental knowledge and environmental attitudes show that high environmental knowledge is often correlated with positive attitudes towards environmental issues. Environmental knowledge includes an understanding of ecosystems, the impact of human activities on nature, as well as solutions to environmental problems, Increasing environmental knowledge can significantly influence an individual's attitude towards environmental protection and preservation[20]. Good environmental knowledge can form a more positive attitude due to a better understanding of the consequences of actions against the environment[21]. Furthermore, environmental attitudes reflect an individual's feelings, beliefs, and evaluations of environmental issues and are often strong predictors of the actions they take to protect. Ajzen in the Theor of Planned Behaviour explains that a positive attitude towards certain behaviours, if supported by several factors, can affect the intention and ultimately the behaviour of the individual. Many studies support this, individuals with a positive attitude towards the environment are more likely to engage in environmentally friendly actions[22]. Data from another study reinforces that 65% of respondents who show positive environmental attitudes engage in pro-environmental behaviour compared to only 25% of those who have negative or neutral attitudes[23].

Data from various studies also show that environmental education that integrates knowledge, attitudes, and behaviors through a holistic approach is more effective in producing long-term behavior change. For example, the "Sustainable U" program at the university in Taiwan Combining lectures on environmental issues with field projects and participation in campus communities resulted in 85% of students involved in the

program reporting improvements in their eco-friendly behaviors compared to 50% of the control group who only received lectures with no practical participation[24]. As such, it is important for universities to develop a comprehensive and integrated approach to promoting environmental behavior. This involves a combination of education, infrastructure support, supportive policies, and the creation of positive social norms. This study aims to see how environmental intelligence affects environmental knowledge and environmental attitudes, as well as how environmental intelligence and environmental attitudes can affect students' environmental behavior in higher education. With the right approach, universities can play a role as a significant agent of change in the global effort to achieve environmental sustainability.

## 2 Method

This research develops a behavioral theory from Ajzen called the Theory of Planned Behavior. The theory looks at the development of various factors that can affect individual intentions so that individual behavior is formed. The approach used is quantitative exploratory as a way to look deeper into factors that can improve environmental behavior, especially in universities. The research locations in universities that participated in the UI Greenmetrics assessment in Central Java and Yogyakarta were 5 universities. The study population was university students at the research location and the sample used the Lemeshow formula because the population number is not known for sure with a 50:50 chance of right and error and a margin of error of 5%. So that the sample obtained was 385 respondents with a quota sampling technique for each university, 77 students were taken as respondents. Data using primary data were collected by questionnaire and analyzed by SEM using the WarpPLS tool.

## 3 Result and Analysis

### 3.1 Outer Model

The external model evaluates the accuracy and dependability of the variables under investigation. The accuracy of the research is determined through two types of validity: convergent validity and discriminant validity. On the other hand, dependability is assessed by examining the consistency and reliability of the indicators. Convergent validity is gauged by the Average Variance Extracted (AVE) value for each variable. A variable is considered valid if its AVE value is greater than 0.5. The following are the obtained AVE values for each variable:

**Table 1.** Variable AVE Value

<b>Variable</b>	<b>AVE value</b>	<b>Information</b>
EK	0.558	Valid
EI	0.580	Valid
EA	0.577	Valid
EB	0.526	Valid

Source: data processed in 2024

According to the provide table, all variables meet the validity criterion as their AVE value exceed 0.5. Additionally, to assess discriminant validity, AVE square values and correlations between construct are considered, where discriminant validity is established when the square root of AVE values is greater than the correlation between constructs. The variable correlation value is shown below:

**Table 2.** Correlations Among Latent Variables

	<b>EK</b>	<b>EI</b>	<b>EA</b>	<b>EB</b>
EK	0.747	0.085	0.125	0.231
EI	0.085	0.762	-0.054	-0.114
EA	0.125	-0.054	0.760	0.416
EB	0.231	-0.114	0.416	0.725

Source: data processed in 2024

By referring to the provided table, it is evident that the square root of the AVE values is greater than the correlation between constructs within the diagonal section of the variables related to environment knowledge, environment intelligence, environment attitudes, and environment behaviour. This confirms the validity of the study in terms of both convergent and discriminant aspects among variables. Additionally, the reliability of the variables is assessed by examining the composite reliability values, which should exceed 0.70. The following table displays the value of composite reliability:

**Table 3.** Composite Reliability Value

<b>Variable</b>	<b>Composite Reliability</b>
EK	0.834
EI	0.845
EA	0.913
EB	0.815

Source: data processed in 2024

Referring to the provided table, the research variables are deemed reliable as they meet the criterion of composite reliability (>0.70). Moving forward, the construction of the indicators for each variable will be conducted to identify reflective indicators. Indicators with loading factor values below 0.40 should be eliminated, as they can introduce bias to the variables and hinder hypothesis testing. The table below illustrated the measurement of reflective indicators through loading factor values:

**Table 4.** Value Loading Factor

<b>Indicators</b>	<b>Loading Factor</b>	<b>P-value</b>
EI.3	0.679	<0.001
EI.6	0.788	<0.001
EI.7	0.773	<0.001
EI.8	0.744	<0.001
EK.1	0.851	<0.001

EK.3	0.628	<0.001
EK.4	0.798	<0.001
EK.6	0.752	<0.001
EA.1	0.783	<0.001
EA.2	0.639	<0.001
EA.3	0.784	<0.001
EA.4	0.628	<0.001
EA.5	0.912	<0.001
EA.6	0.865	<0.001
EA.7	0.419	<0.001
EA.8	0.912	<0.001
EB.1	0.758	<0.001
EB.3	0.688	<0.001
EB.6	0.795	<0.001
EB.8	0.650	<0.001

Source: data processed in 2024

The loading factor value for this study is above 0.40, indicating that co indicators need to be excluded from each variable. The indicator with the highest loading factor value signifies its strong influence on the level of correlation between independent and dependent variables. All variables have fulfilled the criteria of the outer model, allowing the research framework to proceed with the analysis of the inner model. In the WarpPLS analysis, certain criteria for fit and quality index models must be satisfied. The results of the fit and quality index model are presented below:

**Table 5.** Fit Model and Quality Index

No	Fit Model and Quality Index	Result	Note
1	APC	0.220 p < 0.001	Accepted
2	ARS	0.103 p = 0.004	Accepted
3	AARS	0.099 p = 0.009	Accepted
4	AVIF	1.005	Ideal
5	AFVIF	1.147	Ideal
6	GoF	0.240	Large
7	SPR	1.000	Ideal
8	RSCR	1.000	Ideal
9	SSR	1.000	Accepted
10	NLBCDR	0.800	Accepted

Source: data processed in 2024

The presented table indicates that the research models structure yields favorable results, allowing for the continuation of the analysis of the inner model and hypothesis testing. Consequently, both the indicator construct and model structure are deemed satisfactory, affirming the viability of proceeding with further research.

### 3.2 Inner Model

The inner model focuses on exploring the relationships and correlations between pre-determined variables within the structural and conceptual framework. The figure below illustrates the correlations between the variables in this study.

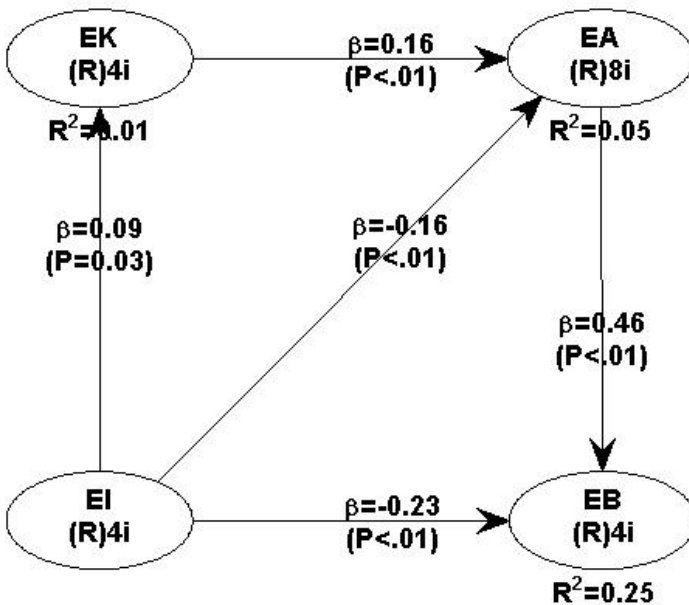


Figure 1. Research Model

Table 6. Research Model Results

No	Line	Coefficient	P-value	Note
1.	Environmental intelligence affects environmental knowledge	0.095	0.030	Accepted
2.	Environmental intelligence affects environmental attitudes	-0.156	< 0.001	Accepted
3.	Environmental intelligence affects environmental behaviour	-0.231	< 0.001	Accepted

4	Environmental knowledge affects environmental attitudes	0.161	< 0.001	Accepted
5	Environmental attitudes affect environmental behaviour	0.458	< 0.001	Accepted

Source: data processed in 2024

### 3.3 Environmental Intelligence Affects Environmental Knowledge

The results showed that environmental intelligence had a significant positive influence on environmental knowledge with a coefficient value of 0.095 and a p-value of 0.030. A p-value smaller than 0.05 indicates that the hypothesis is accepted, confirming that a person's increased environmental intelligence correlates with an increase in their environmental knowledge. This means that individuals with the ability to understand and manage environmental information tend to have a better understanding of environmental issues.

In the framework of the Theory of Planned Behaviour (TPB), these results reinforce the important role of cognitive factors in shaping individual behavior related to the environment. The SDGs stated that behavior is influenced by several factors. Environmental intelligence, which includes the ability of individuals to understand and process environmental information, can increase positive attitudes and control perceived behavior related to environmental issues. Thus, the increase in environmental intelligence can contribute to the increase in environmental knowledge which in turn will affect pro-environmental behavior.

Many studies have also shown a link between environmental intelligence and environmental knowledge. Where individuals with higher levels of environmental intelligence tend to have more comprehensive knowledge about environmental issues and are more able to apply that knowledge in daily life[25], [26]. On the other hand, education related to the environment that increases environmental intelligence plays an important role in increasing environmental knowledge and environmentally friendly behavior[27]–[29].

Universities in Indonesia emphasize the importance of environmental intelligence in a specific context. In universities in Indonesia, they have educational programs or community initiatives that are designed to increase people's environmental intelligence. These programs are conducted with activities such as workshops, seminars, and environmental awareness campaigns that focus on providing accurate and relevant information on environmental issues. Related to this discussion, the findings of this study emphasize that efforts to increase environmental intelligence in the community can effectively increase environmental knowledge, which ultimately encourages people to be more concerned and active in protecting their environment.



### **3.4 Environmental Intelligence Affects Environmental Attitudes**

The results of this study show that environmental intelligence has a negative and significant influence on environmental attitudes with a  $p < 0.001$  and a coefficient of  $-0.156$ . A very small P-value suggests that this relationship is statistically significant, and the hypothesis that environmental intelligence influences environmental attitudes is acceptable. A negative coefficient of  $-0.156$  indicates that an increase in environmental intelligence is paradoxically related to a decrease in environmental attitudes.

In the Theory of Planned Behaviour, these results show interesting dynamics. Attitudes towards the environment should be positively influenced by increased knowledge and understanding. However, these negative results may indicate that the higher a person's level of understanding of environmental issues the more likely they are to be aware of the complexity and difficulty of addressing environmental issues, which can lead to more skepticism or pessimism about the possibility of positive change.

Some previous studies have shown that deeper environmental knowledge can lead to a more critical attitude towards conservation efforts that are considered insufficiently effective or small-scale compared to existing problems [30], [31]. Individuals with a higher understanding of the environment are often more aware of the challenges and obstacles to implementing change, which can lead to more negative or pessimistic attitudes.

This research field study sees the contrast in terms of providing education related to the environment within the scope of higher education. Universities in Indonesia often conduct education or exposure to high environmental information in it. However, the information conveyed is more likely to be about the problems that occur and only emphasizes the great challenges and difficulties in overcoming environmental problems. Exposure tends to only explain difficulties and problems without offering effective and realistic solutions, which can lead to more negative attitudes among individuals with higher environmental intelligence. Negative information without a real solution and only emphasizing the part of the problem that seems to have no solution at all, will lower a person's attitude to be more active in protecting the environment. With this study, this study emphasizes the importance of a balanced presentation of environmental information, which not only highlights problems but also implementable solutions, to encourage a more positive and proactive attitude towards environmental issues.

### **3.5 Environmental Intelligence Affects Environmental Behaviour**

The results showed that environmental intelligence had a negative and significant influence on environmental behavior, with a  $p$  value of  $< 0.001$  and a coefficient of  $-0.231$ . A very small P-value suggests that this relationship is statistically significant, and the hypothesis that environmental intelligence influences environmental behavior

is acceptable. However, the existence of a negative coefficient of -0.231 indicates that an increase in environmental intelligence is actually related to a decrease in environmental behavior.

In the framework of the Theory of Planned Behaviour (TPB), these results show that understanding and knowledge of the environment do not necessarily encourage pro-environmental behavior. In this context, there may be other factors that affect the relationship between environmental intelligence and environmental behavior, such as supportive social norms or practical barriers that hinder the implementation of pro-environmental behavior. In this case, individuals with a high level of environmental intelligence about environmental issues, are not always involved in real actions that have an impact on the environment[32]. This can be due to several things such as the inability of individuals to overcome practical barriers, lack of social support for pro-environmental behavior, or even conflicts between individual values and the actions necessary to protect the environment[33]

There are several dynamics between environmental intelligence and environmental behavior in universities in Indonesia. There are several factors that ultimately affect the relationship between the two variables, such as inadequate environmental policies, lack of supportive infrastructure, and social norms that are less supportive of pro-environmental behavior. Some of the pro-environmental policies that have been set are only limited to policies that are not enforced. As a result of several policies that are only limited to writing, environmental behavior in students decreases even though they have better environmental intelligence. Therefore, it is important to look beyond just the level of knowledge or understanding of the environment in an effort to understand and encourage pro-environmental behavior, taking into account specific social and cultural contexts.

### **3.6 Environmental Knowledge Affects Environmental Attitudes**

The results of this study show that environmental knowledge has a positive and significant influence on environmental attitudes, with a p value of  $< 0.001$  and a coefficient value of 0.161. The relationship between these two variables is very significant when viewed from a statistically small p-value, so the hypothesis that environmental knowledge affects environmental attitudes is acceptable. A positive coefficient of 0.161 indicates that an increase in environmental knowledge contributes to an increase in positive attitudes towards the environment.

Within the framework of the Theory of Planned Behaviour, high environmental knowledge can form a more positive attitude because more knowledgeable individuals tend to have a better understanding of the importance of protecting the environment, as well as the positive impact of pro-environmental actions. This increases their intention to engage in eco-friendly behavior. Previous research supports these findings when higher environmental knowledge significantly increases positive attitudes towards the environment and a tendency to engage in pro-environmental actions[34]–[36]. Environmental knowledge is a strong predictor of a positive attitude towards the environment, which in turn increases the likelihood of pro-environmental behavior.

The field study in the study provides additional context regarding the influence of environmental knowledge on environmental attitudes. In universities in Indonesia, education and environmental awareness programs have played an important role in increasing public knowledge about environmental issues. Until now, many programs have been carried out are seminars related to the environment, real action activities such as planting trees in deforested forests and adding courses related to the environment, which can strengthen students' positive attitudes towards the importance of protecting the environment. Therefore, this study emphasizes the importance of education efforts and the dissemination of information related to the environment as an effective strategy to form positive attitudes and encourage pro-environmental behavior in students.

### **3.7 Environmental Attitudes Affects Environmental Behaviour**

The results showed that environmental attitudes had a positive and significant influence on environmental behavior with a p value of  $< 0.001$  and a coefficient value of 0.458. A very small P-value suggests that this relationship is statistically significant, so the hypothesis that environmental attitudes influence environmental behaviour is acceptable. These results are consistent with the theory of SDGs used. Where the predictor of positive attitudes towards the environment, in this case environmental attitudes are strong predictors of pro-environmental intentions and behaviors. Individuals who have a positive attitude towards the environment are more likely to engage in actions that support environmental sustainability because they have a higher awareness and motivation to protect and care for the environment.

The results of this study are in line with previous research which also shows that a positive attitude towards the environment is the most important factor that can affect environmental behavior[37]. A positive environmental attitude significantly increases the likelihood that a person will engage in eco-friendly behavior and even not hesitate to disseminate the behavior he or she is already doing[38]. One of the founders of high environmental attitudes is environmental knowledge. So indirectly, environmental knowledge contributes positively to students' environmental behavior.

Currently, universities in Indonesia have implemented a new curriculum where several courses in it must discuss related to the environment. In fact, some lecturers still insert environmental issues into their course materials even though the course does not specifically discuss the environment. In addition, universities in Indonesia, especially those that are included in the UI Greenmetrics category, have special programs that are included in student activities such as environmental cleaning, greening, and waste reduction campaigns given to the community. As a result, this positive attitude is reflected in daily behavior that is more environmentally friendly. Thus, these findings emphasize the importance of building and reinforcing positive attitudes towards the environment as a key strategy to encourage pro-environmental behavior among students.

## 4 Conclusion

This study shows that environmental intelligence has a significant influence on environmental knowledge, environmental attitudes, and environmental behavior. However, paradoxically, higher environmental intelligence is found to be correlated with more negative environmental attitudes and behaviors. This may be due to increased awareness of the complexity of environmental issues, which can lead to skepticism and pessimism towards positive change. On the other hand, higher environmental intelligence does not always translate into pro-environmental behavior due to the presence of practical barriers and a lack of social and structural support. This research emphasizes the importance of holistic environmental education programs, which not only increase knowledge but also provide practical solutions to environmental problems.

An effective educational program not only addresses real barriers to environmentally friendly behavior. With a well-rounded approach, students can gain the in-depth understanding and practical skills needed to face increasingly pressing environmental challenges. By overcoming obstacles both from the cognitive and practical sides, universities can better prepare students to become effective agents of environmental change. It involves integrating theoretical learning with real field practice, as well as creating an environment that supports the development of pro-environmental attitudes.

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