Impacts of Education and Perception on Vietnamese High School Students' Behaviors Regarding Plastic Waste : The Mediating Role of Attitude

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Abstract

This study was conducted to analyze the direct and indirect relationship between education, perception and behaviors towards the plastic waste of high school students in Vietnam. The study uses data from a survey of 573 high school students in Vietnam. A cross-sectional study design and questionnaire survey method were used to collect data. Exploratory factor analysis (EFA), confirmatory factor analysis (CFA), descriptive statistics, reliability test Cronbach's Alpha and structural equation modelling (SEM) was used for statistical analysis. Research results show that: Attitude factors play an mediating role in the relationship between education, perception and behavior towards plastic waste. The findings of this study provide the basis for proposing measures to improve behaviors towards plastic waste for Vietnamese high school students.

1. Introduction

Plastic is a material that is durable, flexible, lightweight, flexible, impermeable, and low-cost so that it can produce convenient products for consumers and, at the same time, bring high economic value to businesses so that plastics are produced, distributed, and used commonly in everyday life around the globe (Baierl & Bogner, 2021). Humans have produced an enormous amount of plastic worldwide, estimated at 9.2 billion tons between 1950 and 2017, equivalent to more than a ton of plastic for every living person today (Williams & Rangel-Buitrago, 2022). However, after being disposed of, plastic will become a dangerous waste that seriously pollutes the ecosystem, biodiversity, climate change, negatively impacts livelihoods and human health (Barnes et al., 2009; Bläsing & Amelung, 2018; Heidbreder et al., 2019; Horton et al., 2017; Li et al., 2016; World Bank, 2022b).

Currently, plastic pollution has become an urgent problem worldwide. Every year, the world generates 300 million tons of plastic waste, constantly increasing exponentially (Chandran et al., 2020). Of the total plastic ever produced, only 9% of plastic waste is recycled, about 12% is incinerated, while the rest 79% has accumulated in landfills or is discharged into the environment nature (Geyer et al., 2017). Plastic waste, even if collected and put into landfills, still exists for hundreds of years, changing the physical properties of the soil, causing pollution, preventing oxygen from passing through the soil, and causing negative impacts on the environment school (Laskar & Kumar, 2019).

Vietnam is currently one of the countries with the highest amount of plastic consumption in daily life, ranking 4th globally in ocean plastic waste (Bidegain & Paul-Pont, 2018; Chau et al., 2020; Lahens et al., 2018). According to the World Bank's Analysis Report on Plastic Waste Pollution in Vietnam, it is estimated that each year, Vietnam generates 3.1 million tons of plastic waste, of which at least 10% is discharged into the sea (World Bank, 2022a). The amount of plastic waste dumped into the sea in Vietnam accounts for about 6% of the total plastic waste discharged into the world's sea, but only 27% is recycled (Jambeck et al., 2015). In 2018, the average Vietnamese person consumed plastic products up to 41.3 kg of plastic per year (Milne, 2019). The pollution of plastic waste and plastic bags in Vietnam is severe, with plastic waste accounting for 8–12% of domestic waste (Schwenkel, 2018). Plastic waste pollution has become a serious environmental problem and a significant burden for a country with a developing economy like Vietnam.

The most basic and severe cause of plastic waste pollution lies in the limited environmental culture of humans, which is shown through widespread actions today such as littering without sorting, abuse of nylon bags and disposable plastic items because of their low cost and convenience, regardless of the very hard to decompose properties of plastic (Vương, 2021). In the National Action Plan on Marine Plastic Waste Management to 2030, Vietnam aims to cut ocean plastic waste by 50% by 2025 and 75% by 2030. To reduce plastic waste in Vietnam, it is necessary to implement many solutions synchronously. One of the essential solutions is education to change consumption habits and raise public awareness about plastic waste, reduce the use of plastic products, especially single-use plastics, to promote and encourage the community to recycle and reuse plastic products or use environmentally friendly alternatives (Chau et al., 2020; Dang et al., 2021; World Bank, 2022b).

High school students are an important force in the fight against plastic waste. In Vietnam, children under 18 years old account for about one-third of the population, including 2.8 million high school students, accounting for 2.84% of Vietnam's population in 2021(Vietnam General Statistics Office, 2021). Students are both factors that make plastic pollution as serious as it is today, but at the same time, they also can participate in environmental protection and reduce plastic waste. Therefore, raising awareness,

attitudes and behaviors about plastic waste for students is necessary for the sustainable development of Vietnam in particular and humanity in general.

In the world, there have been several studies on high school students on the plastic waste problem, such as the study in the United Arab Emirates (Hammami et al., 2017), Japan (Uehara, 2020), study on the role of education in plastic waste management (Chow et al., 2017)... In Vietnam, in recent years, there have been several studies investigating the factors affecting the plastic use behavior of residents or visitors in some cities of Vietnam (for example, Hanoi, Da Lat, Da Nang, and Hue) was carried out (Bui et al., 2013; Dung & Cuc, 2021; Phan et al., 2022; Quốc et al., 2020). However, there is a lack of studies on the relationship between education, perception, and attitude to behavior towards the plastic waste problem of high school students. From that gap, we have selected this study to explore the direct and indirect influence of educational, perception to behavioural factors on high school students' plastic waste problem. From there, we propose appropriate educational measures to raise a perception, change attitudes and improve behavior of high school students towards the plastic waste problem in the direction of environmental protection.

2. Theoretical foundations and research models

2.1. The relationship between education and behavior towards the plastic waste problem

Education plays an essential role in the sustainable development of society (Filho et al., 2015). For the plastic waste problem, in addition to economic and legal interventions, psychological interventions such as education to raise awareness and encourage behavior change have a significant impact (McCoy et al., 2018; Thompson et al., 2009). Hammami et al. (2017) argue that education is the only tool that can be used in this critical time to combat social indifference to the war on plastic waste and environmental problems are under threat, especially among students (Hammami et al., 2017). Situmorang et al. also said that people more involved in environmental education activities would increase behaviors against environmental issues, including the plastic waste problem (Situmorang et al., 2020). The 1977 Intergovernmental Conference on Environmental Education in Tbilisi also affirmed that education could change behavior by providing social groups and individuals with opportunities for active participation at all levels towards solving environmental problems (Chow et al., 2017; Hungerford & Volk, 1990).

From that basis, we propose the following hypothesis:

Hypothesis 1

(H1). Education positively correlates with behavior towards the plastic waste problem of Vietnamese high school students.

2.2. The mediating role of attitudes in the relationship between education and behavior towards the plastic waste problem

The relationship between education, attitudes and behavior towards the problem of plastic waste has long been of research interest. On the one hand, several previous studies have shown that the level of formal education a person receives is directly correlated with the amount of environmental knowledge and the formation of positive attitudes towards the environment in the person's own life (Chow et al., 2017). Education is seen as a powerful weapon to form a positive attitude towards a healthier living environment and a higher quality of life (Avan et al., 2011; Nagra, 2010). The goal of environmental education in general and plastic waste education, in particular, is to change people's attitudes by " helping social groups and individuals acquire a set of values and feelings of concern for the environment and motivation for actively participating in environ-mental improvement and protection"(Chow et al., 2017; Hungerford & Volk, 1990). In addition, educating students about environmental issues is beneficial to the establishment and maintenance of environmentally responsible behaviors by students now and into the future as they mature (Damerell et al., 2013).

On the other hand, attitude is the fundamental driver of human behavior towards the environment as it determines the stimuli with which the individual will approach or avoid environmental problems (Steg & Vlek, 2009). Some studies show that individuals' attitudes impact the behavior of reducing plastic waste. People with a positive attitude towards the environment will

avoid using plastic products or increase the reuse and recycling of plastic (Jeżewska-Zychowicz & Jeznach, 2016; Lea & Worsley, 2008; Yeow et al., 2014).

A study in China (Sun et al., 2017) has shown that attitudinal factor is one factor that positively influences people's intention to use plastic bags. Research on factors affecting the behavior of reducing plastic use in Malaysia also shows that: the factor that has the most significant influence on people's intention to reduce single-use plastic is the attitude towards the plastic waste problem (Van et al., 2021). Research by Ajzen (2012) also confirms that attitude is one of the decisive factors in human behavior (Ajzen, 2012).

Therefore, we propose the following hypothesis:

Hypothesis 2

(H2). Attitudes mediate the relationship between education and behavior towards the plastic waste problem in Vietnamese high school students.

2.3. The relationship between perception and behavior towards the plastic waste problem

Perception of environmental issues (including plastic waste), including the perception of the problem's current state, causes, contributors, and impacts (Hammami et al., 2017). Perception of a problem contributes to change in people's behavior because perception clearly affects their attitude and willingness to change (Hammami et al., 2017). If consumers are fully aware of the impact of plastic waste on the environment, they will reduce their plastic consumption behavior, especially single-use plastic (D'Astous & Legendre, 2009). Anggraini et al. also said that the key to educating the community about the management and use of plastic is to raise their perception of the direct impact of plastic pollution on their health (Anggraini et al., 2019).

Therefore, we propose the following hypothesis:

Hypothesis 3

(H3). Perception positively correlates with behavior on the plastic waste problem of Vietnamese high school students.

2.4. The mediating role of attitudes in the relationship between perception and behavior towards the plastic waste problem

Similar to the relationship between education, attitude and behavior on the plastic waste problem, the relationship between perception, attitude and behavior about the plastic waste problem has also attracted the attention of researchers. First, perception is seen as a prerequisite for forming a positive attitude towards the environment of each individual (Mobley et al., 2010). Raising perception about environmental issues will change individuals' attitudes towards the environment, thereby strongly influencing environmental behaviors and reducing people's irresponsible behavior towards the natural environment (Kollmuss & Agyeman, 2002). Research results in secondary school students in the UAE also confirm that the student's perceptions have an evident influence on students' attitudes and willingness to change towards the plastic pollution problem (Hammami et al., 2017). Then, attitudes were found to be positively associated with individuals' behavior towards the plastic waste problem (Ajzen, 2012; Jeżewska-Zychowicz & Jeznach, 2016; Lea & Worsley, 2008; Sun et al., 2017; Yeow et al., 2014). From the above analysis, we propose the following hypothesis:

Hypothesis 4

(H4). Attitudes mediate the relationship between perception and behavior towards the plastic waste problem in Vietnamese high school students.

Based on the theory mentioned above, we propose the following research model shown in Fig. 1.

3. Methodology

3.1. Sample and Procedure

*** Sample**

In this study, we have conducted measures to measure the perception, attitude, behavior, and level of educational access to the plastic waste problem of 600 Vietnamese high school students based on reference sample size in several studies (Hair et al., 2019; Raykov, Tenko; Widaman, 1995). After removing invalid questionnaires, the number of valid questionnaires remaining is 573 (accounting for 95.5%). Table 1 presents the characteristics of the study sample.

Table 1
Survey sample characteristics

		No.	%
Sex	Male	238	41.5
	Female	335	58.5
Grade	Grade 10	244	42.6
	Grade 11	165	28.8
	Grade 12	164	28.6
Total		**573**	**100.0**
*** Procedure**			

- Step 1: We built the questionnaire based on the literature.

- Step 2: We asked for the consent of the Principal, teachers, parents and students of the high schools we surveyed. Before obtaining consent from participants in the survey process, we clearly explained the study and its purpose to the participants. At the same time, ensure the privacy and confidentiality of the information that will be collected.

- Step 3: Official survey on 600 students was conducted through a centralized paper survey and an online survey on Google Forms link from September to November 2022.

- Step 4: Synthesized and processed survey results by mathematical statistical method on 573 valid samples, using SPSS 26.0 and Amos 20.0 software.

- Step 5: Analyzed the research findings.

3.2. Measures

This study aims to measure the impact of educational and cognitive factors on the behavior of Vietnamese high school students regarding the plastic waste problem and the mediating role of attitude factors. To accomplish this purpose, we have built the scale ourselves based on a reference to the scale in previous studies (Table 2). Our scale is designed with 28 observed variables with four factors: perception of the plastic waste problem (PWP Perception), attitude towards the plastic waste problem (PWP Attitude), level of education access to the plastic waste problem (PWP Education), behavior towards the plastic waste problem (PWP Behavior). The scale is designed as a 5-point Likert scale, from 1 (Never) to 5 (Always) and from 1 (Strongly disagree) to 5 (Strongly agree). The specific levels of the scale and reference sources to build the scale are shown in Table 2.

Table 2
Questionnaire's reference sources and five point Likert scale

Component	Items	Reference sources	5-point Likert scale
PWP Perception	**07**	(O'Brien & Thondhlana, 2019) (Abd Hamid & Wan Yahaya, 2020) (Oturai et al., 2022) (Hammami et al., 2017) (Heidbreder et al., 2019) (Widayat et al., 2022)	1. Strongly disagree 2. Disagree 3. Neutral 4. Agree 5. Strongly agree
PWP Attitude	**06**	(Avan et al., 2011) (Chaudhary et al., 2020) (Afroz et al., 2017) (Hammami et al., 2017)	
PWP Behavior	**07**	(Partono et al., 2020) (Abd Hamid & Wan Yahaya, 2020) (Heidbreder et al., 2019) (Nguyen et al., 2022) (Oturai et al., 2022) (Van et al., 2021) (Widayat et al., 2022)	1. Never 2. Rarely 3. Sometimes 4. Often 5. Always
PWP Education	**08**	(Hammami et al., 2017) (Chow et al., 2017)	

The scale was tested on 192 students with the Cronbach's Alpha reliability of the whole scale reaching 0.953 (in which the PWP Perception factor was 0.946, the PWP Attitude was 0.931, the PWP Education was 0.938 and the PWP Behavior was 0.916), shows that the scale has high reliability for inclusion in the official survey.

3.3. Data Analysis

In this study, we used SPSS software version 26.0 and Amos software version 22.0 to analyze descriptive statistics, test the reliability of the scale, analyze exploratory factor analysis (EFA), confirmatory factor analysis (CFA), using the Structural Equation Modeling (SEM) method to test the proposed research hypotheses H1, H2, H3, H4 in the model. Finally, using the normalized regression coefficient to show the different degrees of influence between each pair of hypotheses to clarify the analytical contents of the study.

4. Results

4.1. Reliability and validity of research instruments

Exploratory factor analysis EFA

The results from the study indicated the reliability and validity of the measurement scale. The KMO coefficient of 0.927 demonstrates that the EFA discovery factor analysis is suitable with the research data. Bartlett's Test sig value is 0.00 < 0.05, indicating that the observed variables are correlated with each other in the factor and have statistical significance. Total Variance

Explained is 64.121% > 50%, that is, the standard part is more significant than the partial and the error, meeting this condition, the EFA model is suitable. The results of the factor loading coefficient through the analysis of the rotation matrix (Pattern Matrix) are all > 0.5, showing that the observed variable has good statistical significance. The factor loading factors are shown in detail in Table 3.

Table 3
Factor loadings

Items	Factor Loading			
	Factor 1	Factor 2	Factor 3	Factor 4
PWP Education 4	.828			
PWP Education 2	.814			
PWP Education 3	.807			
PWP Education 1	.779			
PWP Education 5	.729			
PWP Education 6	.714			
PWP Education 7	.671			
PWP Education 8	.635			
PWP Perception 2		.848		
PWP Perception 4		.847		
PWP Perception 1		.834		
PWP Perception 3		.789		
PWP Perception 5		.760		
PWP Perception 6		.735		
PWP Perception 7		.723		
PWP Behavior 4			.777	
PWP Behavior 6			.773	
PWP Behavior 5			.757	
PWP Behavior 2			.750	
PWP Behavior 3			.737	
PWP Behavior 1			.735	
PWP Behavior 7			.697	
PWP Attitude 5				.811
PWP Attitude 4				.791
PWP Attitude 3				.774
PWP Attitude 1				.772
PWP Attitude 6				.762
PWP Attitude 2				.721
Confirmatory factor analysis CFA				

In order to measure the fit of the model and evaluate the reliability of the scales, the study conducted confirmatory factor analysis (CFA). Firstly, evaluate the overall fit of the data based on the model metrics (Model fit). In this study, the indexes Chi-square/df = 2.575 < 5, CFI = 0.943 > 0.80, NFI = 0.911 > 0.80, GFI = 0.893 > 0.85, AGFI = 0.874 > 0.80, RMSEA = 0.053 < 0.08, all indexes have met the required thresholds.It can be considered that the research model fits the data well. Secondly, to evaluate the scale's reliability, this study uses the following indicators, including composite reliability (CR), total extracted variance (AVE) and Cronbach's Alpha coefficient. All the valuesare above the minimum requirements of CR of 0.7, AVE of 0.5, and Cronbach's Alpha of 0.8 (as shown in Table 4), which can confirm that the scales meet the requirements. Thirdly, test the convergence value. The results of the CFA test show that the observed variables belonging to the factors all have estimated coefficients more significant than 0.5, and all p-values are less than 0.05, which is statistically significant.

Table 4
Assessment of reflective measurement model

Factor	Cronbach's Alpha	Composite reliability	AVE
PWP Perception	0.918	0.919	0.621
PWP Attitude	0.897	0.898	0.594
PWP Education	0.904	0.907	0.552
PWP Behavior	0.894	0.894	0.548

4.2. Correlation analysis among factors

Table 5 presented the mean scores, standard deviation and correlation coefficient between the perception, attitude, education and behavior of high school students towards plastic waste. The data in Table 5 shows that the scores of perception, attitude, education and behavior of high school students towards the problem of plastic waste are 4,173 (SD = 0.769); 4.061 (SD = 0.78549); 3.5598 (SD = 0.82203) and 3.4468 (SD = 0.86191), respectively. Perception is positively correlated with attitude (r = 0.523; p < 0.01); Perception is positively correlated with education (r = 0.110; p < 0.01) and behavior (r = 0.103; p < 0.05). Attitude is positively correlated with education (r = 0.168; p < 0.01) and behavior (r = 0.187; p < 0.01). Education positively correlates with behavior (r = 0.526; p < 0.01).

Table 5
Mean score, standard deviation and correlation matrix between variables

Factor	Mean	SD	PWP Perception	PWP Attitude	PWP Education
PWP Perception	4.1730	.76999	1		
PWP Attitude	4.0611	.78549	0.523**	1	
PWP Education	3.5598	.82203	0.110**	0.168**	1
PWP Behavior	3.4468	.86191	0.103*	0.187**	0.526**

4.3. Moderated Mediation Analyses

The study uses the method of structural equation modelling (SEM) to test the proposed research hypotheses in the model, and the results show the appropriateness of the structural model compared with the data. The indexes Chi square/df = 2.575 < 5, CFI = 0.943 > 0.80, NFI = 0.911 > 0.80, GFI = 0.893 > 0.85, AGFI = 0.874 > 0.80, RMSEA = 0.052 < 0.08 are all satisfied.

Table 6
Direct and indirect effects of education and perception on the behavior of the plastic waste problem

Effects	B	Sig. (p values)	95% CI
PWP Education ◊ PWP Behavior	0.546	0.000 < 0.05	[0.473; 0.620]
PWP Education◊PWP Attitude	0.107	0.002 < 0.05	[0.040; 0.174]
PWP Attitude◊PWP Behavior	0.205	0.000 < 0.05	[0.117; 0.294]
PWP Education◊PWP Attitude◊PWP Behavior	0.017	0.007 < 0.05	[0.003; 0.037]
PWP Perception ◊ PWP Behavior	0.051	0.201 > 0.05	[-0.027; 0.130]
PWP Perception ◊PWP Attitude	0.521	0.000 < 0.05	[0.450; 0.593]
PWP Perception◊PWP Attitude◊PWP Behavior	0.107	0.016 < 0.05	[0.042; 0.177]

Table 6 and Fig. 2 present the direct and indirect effects of education and perception on the behavior of plastic waste in Vietnamese high school students. The results show that the direct impact of education on behavior is statistically significant (B = 0.546, p = 0.00 < 0.05, CI= [0.473; 0.620]); indirect impact from education to behavior through attitude is statistically significant (B = 0.017, p = 0.007 < 0.05, CI=[0.003; 0.037]). The above results show that the attitude is partly mediating the relationship between education and behavior of Vietnamese high school students regarding the plastic waste problem. The direct effect from cognition to behavior is not statistically significant (B = 0.051, p = 0.201 > 0.05, CI=[-0.027; 0.130]); the Indirect impact from perception to behavior through attitude is statistically significant (B = 0.107, p = 0.016 < 0.05, CI=[0.042; 0.177]). The above results show that the attitude completely mediates the relationship between education and behavior on the plastic waste problem of high school students in Vietnam.

The results of the research model are presented as follows:

5. Discussion

Consistent with hypothesis H1, our research results have shown that education directly predicts behaviors towards plastic waste in Vietnamese high school students. This result is similar to the finding of a study assessing the impact of waste education in schools for 284 high school students in Poland, which demonstrated that education has an impact on changing practices of students' waste management (Grodzińska-Jurczak et al., 2003). Other studies (such as Chow et al., 2017; Damerell et al., 2013; McCoy et al., 2018) have confirmed the positive role of education in directly improving individuals' behavior towards plastic waste which contribute to environmental responsibility.

Consistent with hypothesis H2, our research results have shown that education indirectly impacts the behavior of Vietnamese high school students regarding plastic waste through the medium of students' attitudes toward the plastic waste problem. This result is consistent with many previous studies that suggest that education contributes to changing students' attitudes towards a more positive and healthy way when facing the problem of plastic waste (Desa et al., 2011), attitude plays a predictor role in plastic consumption behavior of individuals in the community (Sun et al., 2017), and attitudes form the basis for individuals to perform environmentally beneficial behaviors (Afroz et al., 2017; Ajzen, 2012). However, previous studies have not explored whether this mediating relationship is partial or complete. In this study, we found that attitudinal factors play a partial mediator in the relationship between education and the behavior of high school students towards plastic waste.

In the relationship between awareness and behavior towards plastic waste, our research results show that the direct impact from perception to behavior is not statistically significant. This rejects hypothesis H3 of the study. Although the research results are not consistent with our hypothesis, they are consistent with some previous studies that have demonstrated: no correlation between perception and behavior towards plastic waste (Rayon-Viña et al., 2018), perception of the harmful effects of plastic has no direct impact on plastic use behavior (Hammami et al., 2017; Heidbreder et al., 2019), the factor that has the most negligible impact on people's behavioral intention to reduce single-use plastic is the perception factor (Van et al., 2021). The study by Van et al. also confirmed: that a person with an excellent environmental perception and plastic waste does not mean that they will

implement behaviors to reduce plastic use (Van et al., 2021). It also explains that although many students have a good perception of the harmful effects of plastic and plastic waste, they still use plastic on a regular basis.

Supporting hypothesis H4, this study shows that attitudes mediate the relationship between the perception and behavior of high school students on the plastic waste problem. That means perception contributes to changing attitudes towards plastic waste, from attitudes to behaviors to reduce plastic waste. This result is consistent with previous studies, such as a study on a sample of 400 high school students in the UAE showed that students' perception of plastic pollution clearly affects their attitudes and willingness to change their change in plastic consumption, thereby contributing to behavior change towards environmentally responsible (Hammami et al., 2017); Attitude is the primary determinant of consumer plastic recycling behavior (Heidbreder et al., 2019). However, previous studies have not explored the mediating effect of attitudes in the relationship between perception and behavior towards the problem of plastic waste among high school students. Our research has shown that attitude plays a fully mediating role in this relationship.

6. Conclusion

Plastic waste pollution has become one of the current severe environmental problems for Vietnam and many countries around the world. Because of its convenience and economic value, the use of plastic is increasing regardless of the harms and dangers that come with it. To contribute to reducing plastic waste for sustainable development, it is necessary to implement many solutions for many target groups. In particular, raising awareness and educating individuals about the responsibility of using and reducing plastic waste is essential for sustainable development (UNEP, 2018).

This study explores the impact of education and perception factors on the attitudes and behaviors of Vietnamese high school students towards the plastic waste problem. The study results show that the educational factor has a positive, direct and indirect impact on the behavior of reducing plastic waste of Vietnamese high school students, mediated by attitude. Although the perception factor does not directly affect students' behavior towards the plastic waste problem, it has an indirect effect through a mediator, whichis attitude. This is a novel finding compared with previous studies as it confirms the mediating role and specific impact of attitudinal factors in the relationship between education, perception and behaviors of high school students towards te plastic waste. The results show that to establish and maintain responsible behaviors of Vietnamese high school students towards the plastic waste problem, it is necessary to strengthen education and communication measures to raise a perception, changing attitudes and thereby improving environmentally responsible behavior. The research provides information for educational management agencies, high schools, and high school teachers in Vietnam to develop suitable policies, programs and activities to educate environmental responsibility for high school students.

Although specific results were obtained, this study still has some limitations. First, the new study tested the hypothesis with high school students in one city but did not extend to other cities in Vietnam. Secondly, factors affecting students' behavior towards the plastic waste problem such as knowledge, habits, intentions, social norms, motivation, and interests were not included. To simplify the model, this study selects the prominent factors proposed by some studies as awareness, attitude, and education. Third, the study has yet to show the difference between perception, attitude, level of educational access and behavior towards the plastic waste problem among male and female students, among students of all grades. Fourth, due to the cross-sectional study design, this study does not allow inferring a causal relationship between the research variables. These limitations suggest follow up research by expanding the research's scale, scope and subjects.

Declarations

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Figures

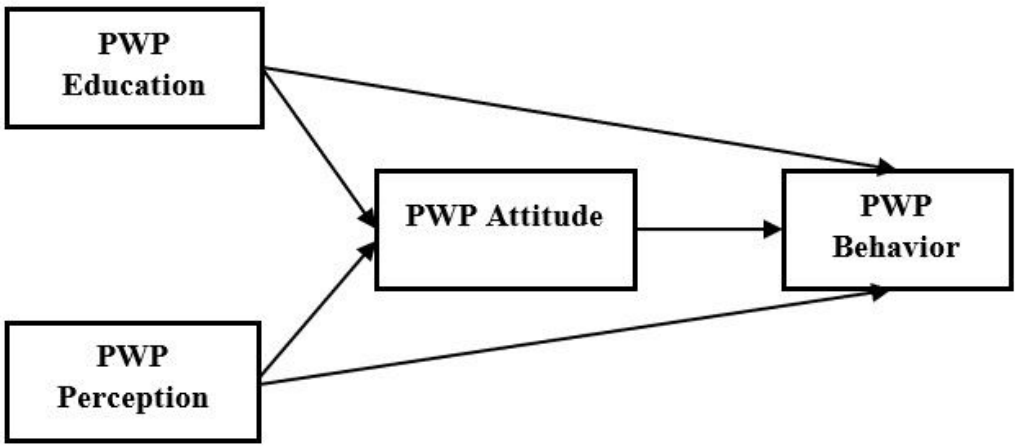

Figure 1

The proposed research framework

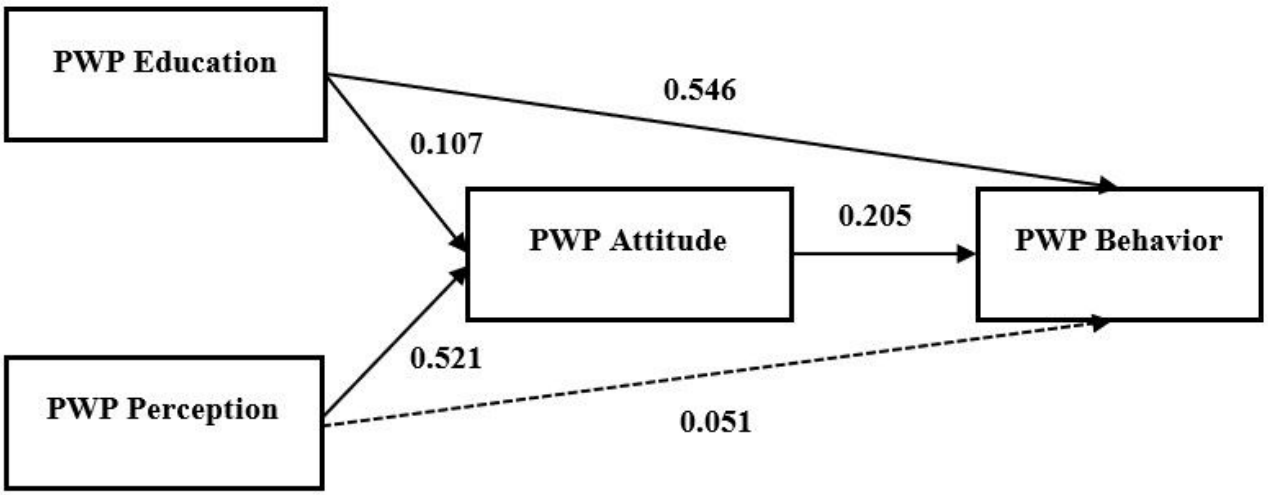

Figure 2

Summary of SEM model estimation results

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