

Article

What Factors and Educational Activities Can Encourage Students to Adopt Sustainable Behaviors? Evidence from Poland

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Abstract

As agents of change and future decision-makers, students will be responsible for implementing the principles and goals of sustainable development. Therefore, it is crucial that they acquire the necessary competencies to engage in sustainable practices, and academic education plays a key role in this regard. In this article our aim is to identify the factors and educational activities that would most effectively encourage students to adopt sustainable behaviors. To this end, a survey was conducted on a sample of 1604 management students at Polish universities. The following statistical methods were used to analyze the raw data: descriptive statistics and box-and-whisker plots, the Mann–Whitney U test, the Kruskal–Wallis test, Dunn’s post hoc tests, and structural equation modelling. It was identified by students that financial benefits were the most effective declared factor to motivate pro-environmental actions. In turn, the actual factor of encouraging students to adopt behaviors consistent with the principles of sustainable development was found to be the promotion of pro-environmental practices and attitudes during lectures and seminars. This factor was the only one in the structural equation model to yield a statistically significant and positive path coefficient (0.684 *). The frequency of adopting sustainable development practices varies depending on gender, high school background, place of residence, and attitudes toward sustainable development. Our research represents one of the first nationwide studies in this field.

Keywords: sustainable development; pro-environmental behavior; motivations; management students; academic education

1. Introduction

One of the major challenges facing modern economies and societies is ensuring sustainable development (SD) by implementing the 17 Sustainable Development Goals (SDGs) adopted by United Nations (UN) member states. Meeting this challenge requires the commitment and cooperation of many stakeholders, including governments, public agencies and institutions, non-governmental organizations, businesses, and the general public. Citizens environmental knowledge, awareness, attitudes, and especially sustainable behaviors are highly desirable, and providing appropriate environmental education at all levels of schooling is essential [1–5]. Studies have shown that people educated in SD from childhood become specialists strongly committed to sustainable actions [6].

In particular, education at the academic level is assigned a special role [7–11]. Students typically demonstrate greater knowledge, awareness, and attitudes, as well as more sustainable behaviors, than the general public [12], which is why they are considered agents and creators of change in the field of SD [13–15]. When their knowledge and competencies



Academic Editor: Eckard Helmers

Received: 8 June 2026

Revised: 4 July 2026

Accepted: 8 July 2026

Published: 10 July 2026

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are translated into action, they can effectively promote and foster eco-friendly activities in society. Furthermore, current students, particularly those in management and administration programs, will determine the pace and direction of economic, environmental, and social development as future managers, entrepreneurs, specialists, and engineers.

As part of their academic education, students acquire relevant knowledge about sustainable development (SD) and environmental issues [16–19]. However, as suggested by the Knowledge–Attitude–Behavior (KAP) model [20], knowledge does not always translate into attitudes and practical actions, as confirmed by numerous studies [10,21–24].

The reasons for this stem from shortcomings in the model itself [25], as well as from the level and quality of academic education. Many students have expressed that the class formats and content used by universities are not sufficiently encouraging or motivating in regard to adopting sustainable practices [9,26–32].

As discussed in environmental psychology theories such as the Knowledge–Attitude–Practice (KAP) model, the Value–Belief–Norm (VBN) theory and the Theory of Planned Behavior (TPB), which have been used by many authors in their research [33–36], the mechanisms leading to pro-environmental behaviors are much more complex. In our approach, we incorporate two additional theories: Protection Motivation Theory (PMT) and Goal–Framing Theory (GFT). These theories were developed further when a significant behavioral paradox was revealed—namely, the discrepancy between the stated and actual motivators of pro-environmental behaviors. Our work builds on the latest research concerning the discrepancies between declarations, attitudes and intentions, and actual human behaviors [37–39] addressing an existing theoretical gap.

Although previous research has focused on the types and determinants of pro-environmental student behavior [40–43], the motivation and effective incentives for adopting sustainable practices remain poorly understood. Our research fills an empirical gap by analyzing the factors that actually encourage students to adopt environmentally friendly behaviors, rather than merely considering them in theory.

Our aim is to identify the most effective factors and forms of initiatives that can encourage students to intensify their sustainable behaviors. We achieved this objective by analyzing survey results using the following statistical techniques: descriptive statistics and box-and-whisker plots, the Mann–Whitney U test, the Kruskal–Wallis test, Dunn’s post hoc tests, and structural equation modelling. A survey was distributed among 1604 management and administration students at technical universities in Poland, who were selected because they will be tomorrow’s leaders, decision-makers, managers, politicians, and specialists.

The following research questions were formulated:

RQ1: What level of engagement in sustainable practices do Polish students demonstrate?

RQ2: Are there differences in the implementation of sustainable actions based on gender, place of residence, high school profile, attitudes toward SD, and pro-environmental practices?

RQ3: Which types of actions do Polish students identify as the most encouraging for sustainable behaviors?

RQ4: What factors encourage students to adopt sustainable behaviors?

The article consists of six sections. Section 2 provides a literature review on the level and determinants of students’ pro-environmental behaviors. Section 3 provides the methodology. Section 4 contains the obtained results. Section 5 provides a discussion, and Section 6 presents the conclusion.

2. Literature Review

2.1. Student Engagement in Sustainable Practices: Levels and Determinants

Engagement in SD can vary in level, scope, and nature. It can manifest as eco-friendly behaviors or actions. Oinonen and Paloniemi [44] note that actions for sustainable development differ from eco-friendly behaviors in terms of effort, commitment, and visibility. This approach distinguishes between behaviors in the private and public spheres, a distinction first proposed by Stern at the beginning of the 21st century [45]. Behaviors refer to engaging in ordinary, everyday practices that reduce negative environmental impact (e.g., waste sorting, energy conservation, and purchasing eco-friendly products). While behaviors do not require significant effort or commitment, as they amount to modifying habitual decisions and are of a private nature, actions involve collective engagement, greater effort, and activity in the public sphere. Examples include participating in and/or organizing large-scale social initiatives such as rallies, protests, tree-planting campaigns, and forest cleanups. These actions aim to influence the behavior of others to bring about positive changes in the socio-environmental system.

Most recent studies indicate that students are moderately to minimally engaged in sustainable practices. The Trends in International Mathematics and Science Study (TIMSS) assessed students' sustainability engagement levels in Europe in the 2023 cycle using the Environmental Attitudes and Behaviors Framework showing that 35.65% of students were highly engaged, 44.75% were moderately engaged, and 19.6% were not engaged [46].

Acuña et al. [47] and Estrada-Araoz et al. [48] conducted research among students at Peruvian universities and found that 17% and 18.2%, respectively, regularly adopt sustainable consumption practices, while 39.5% and 35% occasionally adopt them. Additionally, 43.5% and 46.8%, respectively, never adopt them.

Research findings among Malaysian students have shown that their sustainable behaviors range from “engaged but inconsistent” to “habitual” [49]. In their recent study, Oliveira et al. [50] pointed to low student engagement in environmental protection activities (e.g., caring for flora and fauna, volunteering), despite a high awareness of the importance of biodiversity.

Most sustainable activities undertaken by engaged students relate to behaviors, such as adopting eco-friendly practices at the individual level. The most common of these include waste sorting, recycling, conserving energy and water, purchasing organic food, and eco-friendly mobility and transportation [51–56].

Students engage in broader public-sphere activities much less frequently, if at all. Malaysian students demonstrate a strong personal commitment to certain practices, such as energy conservation, but rarely participate in broader social initiatives [49]. Studies of young people's environmental behaviors in Finland found that the most common practices were waste sorting and walking or cycling instead of driving [44], while respondents were least likely to participate in rallies or protests and were almost never involved in organizing them. Similar behaviors characterize students in India [40], who were found to engage in certain practices, such as energy and water conservation, as a matter of habit, but were less involved in civic activities.

Research on students' sustainable actions in the public sphere has been conducted by [57–59], among others. The focus of Liu, Zou, and Wu's [57] study was the public engagement of Mongolian students at three universities in China Inner Mongolia Autonomous Region (IMAR). In this study, the authors applied the VBN theory and found that altruistic values and pro-environmental personal norms positively impact students' pro-environmental behaviors, while egoistic values negatively impact them, and biospheric values have no significant impact. Piyapong [58] clearly distinguished between environmental behaviors in the private and public spheres, demonstrated that student engagement

in social campaigns and initiatives was most influenced by a sense of moral obligation, belief in one's own efficacy, positive attitudes towards the environment and a sense of personal responsibility for environmental problems. Zhang and Cao [59] demonstrated that, while environmental education does not directly impact student behavior, it can influence changes in attitudes, social norms and self-efficacy. These factors, along with social approval, are the main motivators for students engaging in public action.

Many studies have examined the sociodemographic factors that influence sustainable behavior among students. Most of these studies have shown that gender is a significant differentiating factor. In European countries, particularly Finland, Sweden, Poland, Denmark, and Lithuania, women demonstrate greater sensitivity to environmental issues and are more engaged in sustainable practices [46]. Researchers from other countries, including Jordan [60], Peru [48,61], India [62], Hong Kong [63], and Japan [64], have obtained similar results.

Regarding place of residence, students living in metropolitan areas and large cities appear to be more engaged in sustainable practices than those from smaller towns [65–68].

Attitudes were a significant determinant of the propensity for sustainable behavior (SB) in numerous studies including studies on Portuguese [69], Albanian [70], Iranian [64], Indonesian [23], Vietnamese [71], South African [72], Chinese [41], and Polish [73–76] students.

Boonen et al. [76] and Tarrant et al. [77] demonstrated that students with greater international experience are more committed to sustainable development.

In some countries, significant factors included parents' education level, income per household member, and socioeconomic status—the higher these factors, the greater the students' engagement [40,47].

The above considerations provided the basis for the following research questions:

RQ1: What level of engagement in sustainable practices do Polish students demonstrate?

RQ2: Are there differences in the implementation of sustainable actions based on gender, place of residence, high school profile, attitudes toward SD, and pro-environmental practices?

2.2. *Motives and Incentives for Sustainable Student Behavior*

Research into the underlying factors and motivations behind pro-environmental behavior draws on theories and models developed within the domain of environmental psychology. These theories are most often complementary, and include PMT, the KAP model, VBN theory, TPB, and GFT. With the exception of the KAP model, these concepts assume that knowledge of environmental and climate issues alone, or a sense of threat, does not directly translate into desired behaviors [34]. Such behaviors instead result from complex psychological processes involving values, beliefs, norms, attitudes, a sense of social responsibility and self-efficacy. The study of these processes requires an integration of several theories [78–80].

Our study, along with other research on the underlying factors and determinants of students' eco-friendly behaviors, is based on the aforementioned theories.

Research on the underlying factors and motives of pro-environmental behavior often employs PMT. According to PMT, the motivation to protect oneself from threats drives individuals to take preventive actions [81]. People take specific actions by weighing the costs and benefits of different behaviors.

Perrault and Clark [82] demonstrated in their research that evoking fear and threat alone (e.g., through media messages about a dying planet or impending climate catastrophes) is insufficient for increasing motivation. Messages that reinforce students' sense of self-efficacy are also necessary, and respondents identified subjective norms and external incentives as key motivators for their future pro-environmental behaviors.

Drawing on PMT, Shafiei and Maleksaeidi [83] identified factors that positively and negatively influence students' pro-environmental behaviors. Positive influences included environmental attitude and self-efficacy, while negative influences included the costs of pro-environmental behaviors and the perceived benefits of environmentally unfriendly behaviors. Similar conclusions were drawn by Faghani, Bijani, and Valizadeh [84]. In addition, Salehi, Telešienė, and Pazokinejad [64] confirmed the importance of self-efficacy in reinforcing sustainable behaviors among students in studies on Japanese and Iranian students.

Hou et al. [37] demonstrated the significant role of emotional and ethical factors in motivating pro-environmental behaviors. Emotional factors related to ecological (climate) and social anxiety reinforce internal and external motivation for sustainable behaviors among students, while ethical factors pertain to values such as a sense of responsibility for the state of the environment and social development.

The KAP model provides a parsimonious framework for sustainable behavior, whereby knowledge influences attitudes, which then lead to action. This model has been used in research by [85–87], among others.

The VBN and TPB theories are extensions of the KAP model that explain the psychological mechanisms underlying the formation of pro-environmental behaviors. According to VBN theory, pro-environmental behaviors result from a chain of dependencies: values (biospheric and altruistic) form beliefs about personal responsibility for the issue in question, which in turn generate personal norms—that is, a moral sense of duty—which serve as a direct motivation for the corresponding behavior. TPB states that direct motivation for desired behavior is an intention formed on three foundations: attitude, a socially grounded subjective norm and perceived behavioral control—that is, the belief in one's ability to perform the action (a sense of self-efficacy).

In practice, authors most often draw on both theories—VBN and TPB.

A study by Ortiz-Gómez et al. [88] found that students' values were more significant than their knowledge in justifying their sustainable behaviors. The study also showed that greater knowledge does not influence these behaviors, but rather allows students to critically examine the goals of sustainable development and their actions in this regard.

Similar factors, including environmental values, attitudes, perceived behavioral control, subjective norms, and risk perception, were identified in studies by Irfana et al. [89], Chen and Erfanian [90], Zang et al. [41], and Correia et al. [34].

Studies on Turkish and Romanian students have shown that pro-environmental attitudes promote sustainable behaviors [91]. These attitudes are primarily shaped by concern for the environment and natural resources, as well as cultural factors, such as the values held within the student's family. While the studies by Torroba Diaz et al. [43] and Nurkhin et al. [23] confirmed a similar hypothesis regarding the importance of attitudes, these studies also emphasized the role of environmental education in shaping these attitudes.

As demonstrated by Godinho Filho et al. [33], personal values and beliefs are more effective than external pressure in promoting sustainable actions. In addition, Wu, Zhu, and Zhai [92] found that personal norms effectively explain students' waste management behaviors.

According to the GFT framework, sustainable behavior is not directly determined by environmental knowledge, values, or attitudes, but by the prioritized goal in a given situation: hedonistic, profit, or normative. Desirable pro-environmental behaviors most often occur when a normative goal dominates in conjunction with biospheric values and a sense of environmental responsibility [93].

A study on Indian students revealed that focusing on normative goals increased student interest in eco-friendly actions [94], while pursuing hedonistic and benefit-oriented goals through a normative goal leads to more sustainable pro-environmental behaviors. Ad-

ditionally, the authors emphasized the importance of academic education, noting a stronger orientation towards normative goals among senior students. Mohd Noor and Nordin [95] obtained similar results in their study on Malaysian students, showing that all three goals positively impacted pro-environmental behaviors, with the normative goal having the strongest impact. In a study of students in Bangladesh, Bonhi et al. [96] demonstrated different relationships between goals and pro-environmental behaviors while normative goals had a non-significant effect, hedonistic and profit-seeking goals were dominant.

Torroba-Díaz et al. [43] and Istniana et al. [97] emphasized the importance of environmental intelligence in their research and found that students who develop ecological intelligence during their studies demonstrate greater engagement in sustainable activities. This intelligence allows for a better understanding of the principles and goals of sustainable development, identification of the effects of climate change, and increased sensitivity to the state of the natural environment.

Rampasso et al. [98] examined the factors determining students' engagement in volunteer activities and demonstrated that these include incentives from the university to participate in volunteer programs and the students' own beliefs and values.

Based on the above considerations, the following research questions were formulated:

RQ3: Which types of actions do Polish students identify as the most encouraging for sustainable behaviors?

RQ4: What factors encourage students to adopt sustainable behaviors?

3. Methodology

3.1. Research Procedure

To answer our research questions, we used the results of a survey entitled Nationwide Study of Knowledge and Awareness of Sustainable Development Among Students Enrolled in Management and Administration Programs in Poland. Approval for this study was obtained from the Ethics Committee for Research Involving Human Subjects.

In line with our research topic, the study included students from management and administration departments at Polish technical universities. These respondents were selected because they will become future managers and decision-makers.

The research sample was determined based on data from the Central Statistical Office (CSO) report, "Higher Education in the 2023/24 Academic Year." The size and structure of the data were determined based on the number of students enrolled in the following fields of study: management and administration (field names according to ISCED-F 2013 [99]). According to the data, 166,789 students were enrolled in these fields in 2024. A maximum error of 3% was assumed for the calculations. While the minimum sample size was set at 1060 students, an increased sample size of 1604 students was adopted for the study. To ensure the representativeness of the sample, the regional distribution of students in management and administration programs was determined. Following this, the research sample was distributed among the provinces in proportion to this calculated structure.

A proprietary questionnaire was developed for our study based on a review of the literature on motivation theory and the determinants of pro-environmental behavior [100–102], as well as on Goal-Framing Theory [93]. The questionnaire consisted of 37 closed-ended questions. Responses were rated on a scale from 1 to 5, and a demographic form was also included.

In order to collect information related to our research topic, 12 questions and a demographic survey were utilized, as shown in Table A1. The resulting questionnaire comprised three sections: the initial section addresses the frequency with which sustainable development practices are implemented; the second section inquiries about the motivations and incentives for the implementation of these practices; and the third section collects

sociodemographic information, including gender, the size of the respondent's hometown, and attitudes towards pro-environmental activities.

Questions were selected from existing questionnaires designed to measure pro-environmental behavior and identify influencing factors. In their publication, Shafiei and Maleksaei-Di [103] employed Protection Motivation Theory (PMT) to construct questions regarding behaviors related to sustainable development, evaluated using a 5-point Likert scale. These questions were employed in this study, though some items were reformulated, including reversing the Likert scale (1 = definitely yes/always, 5 = definitely no/never), to make the questions more intuitive and reflective of the actual experiences of Polish students.

Cronbach's alpha was used to determine the reliability of the research tool with the value of 0.83 for the datasets (12 questions and demographic data), indicating good internal consistency among the selected questions [84].

3.2. Research Tools

Various research tools were used to conduct the study (see Table 1) and were selected based on the research questions.

Table 1. Research Tools.

RQ1 and RQ2	RQ3 and RQ4
Descriptive statistics (mean)	Descriptive statistics (mean) and
Mann–Whitney U tests	box-and-whisker plot
Kruskal–Wallis ANOVA tests	Structural equation modelling
Dunn's post hoc test	

Responses to SB1–SB7 were used to answer RQ1 and RQ2, and descriptive statistics were used to present the mean responses. Data from the questionnaire were used to define the following categories: gender; high school profile; place of residence; participation in an environmental campaign; and attitudes toward SD and eco-friendly practices.

Significance tests were then used to identify differences between groups. The type of test depended on the type of variables and the number of groups studied. In this study, the dependent variables are ordinal. For two-groups tests (for the variables of gender and participation in environmental campaign (yes/no)), the Mann–Whitney U test was used. For significance tests involving three or more groups (high school profile, place of residence, and attitude toward sustainable development and environmentally friendly practices, the Kruskal–Wallis test was used. When statistically different groups were identified, Dunn's post hoc tests were conducted.

Descriptive statistics and structural equation modeling were used to answer RQ3 and RQ4. First, to test RQ3, questions F1–F5 were used, and the calculations were based on the means, which were visualized using a box-and-whisker plot. Subsequently, structural equation modeling using the GLS-ML method was employed to answer RQ4. The GLS-ML estimation method can be applied to ordinal data (e.g., Likert scale) if the following conditions are met:

1. The Likert scale must have at least five to seven categories.
2. The variables must be distributed relatively symmetrically and normally around the mean [104].

The questionnaire used in this study employed a five-point scale. According to Table A2, the absolute values of skewness ranged from 0.81 to 1.28 and the absolute values of kurtosis ranged from 0.336 to 3.87. Since the skewness values were less than 2 and

the kurtosis values were less than 7, the research data met the requirement for normal distribution. Thus, this condition is also met.

Questions SB1 through F5 were used to construct the model, with questions regarding motivational factors (F1–F5) served as exogenous variables and questions assessing behavior (SB1–SB7) serving as endogenous variables. The selection of questions was based on the concept proposed by Shafiei and Maleksaeidi [103] and Carducci et al. [56], which is grounded in Protection Motivation Theory (PMT). To select an appropriate model, three variants were tested: a model in which the endogenous and exogenous variables are observed, a model with two latent variables (one for the endogenous variables and one for the exogenous variables), and a mixed model with one latent variable (the endogenous variable) and the exogenous variables as observed. Based on the indicators in Table A3, the mixed model was selected as having the best-fitting parameters.

In the adopted model, questions F1–F5 are explicit exogenous variables, while questions SB1–SB7 were used as factor loadings to create a latent variable named “sustainable behaviors”. To determine the model’s reliability, we used the measures CR (construct reliability) and AVE (average variance extracted). As shown in Table A4, the factor loadings for all items exceed 0.7, the AVE coefficient is 0.89, exceeding 0.5, while the CR coefficient is 0.99, exceeding 0.7. These results confirm the model’s reliability.

Although this model is consistent with our theoretical premises, it is not possible to determine which incentives influence specific sustainable development practices or to what extent. However, it is possible to assess the factors that determine “sustainable behavior” in a general sense.

All calculations were performed using Statistica software version 13.3.

4. Results

In accordance with our outlined research procedure, we begin by addressing RQ1 and RQ2. The results of the calculations are presented in Table 2. The remaining test results can be found in the Supplementary Materials.

Table 2. Descriptive statistics for questions SB1–SB2 and results of significance tests in subgroups.

	SB1–SB6	SB1	SB2	SB3	SB4	SB5	SB6	SB7
Mean (total)	3.17	3.05	3.25	3.14	3.31	3.16	3.20	3.09
Gender								
Mean								
Female	2.93	2.73	3.06	2.88	3.10	2.91	2.96	2.86
Male	3.38	3.32	3.42	3.37	3.49	3.37	3.41	3.29
Results of the Mann–Whitney U significance test, with a significance level of $\alpha = 0.05$								
<i>p</i>		$p < 0.001$	$p < 0.001$	$p < 0.001$	$p < 0.001$	$p < 0.001$	$p < 0.001$	$p < 0.001$
Statistically significant differences		yes	yes	yes	yes	yes	yes	yes
High school profile								
Mean								
Exact sciences	3.18	3.11	3.25	3.12	3.29	3.17	3.20	3.11
Humanities	3.08	2.85	3.25	3.07	3.23	3.13	3.05	3.00
Natural sciences	3.25	3.18	3.25	3.23	3.41	3.19	3.34	3.15

Table 2. Cont.

	SB1–SB6	SB1	SB2	SB3	SB4	SB5	SB6	SB7
Results of the Kruskal–Wallis significance test at a significance level of $\alpha = 0.05$								
<i>p</i>		<i>p</i> = 0.0005	<i>p</i> = 0.9809	<i>p</i> = 0.0799	<i>p</i> = 0.0372	<i>p</i> = 0.7209	<i>p</i> = 0.0014	<i>p</i> = 0.1498
Statistically significant differences		yes	no	no	yes	no	yes	no
Post-hoc test		exact sciences and humanities			natural sciences and humanities		natural sciences and humanities	
Place of residence (number of residents)								
	Mean							
Up to 20,000	3.02	3.00	3.14	3.05	3.08	3.03	2.99	2.87
20,000 to 50,000	3.19	3.01	3.29	3.15	3.34	3.17	3.30	3.03
50,000 to 150,000	3.02	2.91	3.12	2.98	3.19	2.90	3.16	2.92
150,000 to 500,000	3.30	3.19	3.42	3.23	3.35	3.27	3.39	3.21
Over 500,000	3.19	3.05	3.23	3.17	3.38	3.22	3.14	3.16
Results of the Kruskal–Wallis significance test at a significance level of $\alpha = 0.05$								
<i>p</i>		<i>p</i> = 0.1804	<i>p</i> = 0.034	<i>p</i> = 0.2073	<i>p</i> = 0.0188	<i>p</i> = 0.0048	<i>p</i> = 0.0074	<i>p</i> = 0.0083
Statistically significant differences		no	yes	no	yes	yes	yes	yes
Post-hoc test			no indications		over 500,000 and up to 20,000	over 500,000 and 150,000–500,000 and 50–150,000	150,000–500,000 and up to 20,000	no indications
Participation in environmental campaign								
	Mean							
Yes	2.15	1.89	2.28	2.07	2.44	2.04	2.32	1.99
No	3.72	3.67	3.78	3.72	3.78	3.76	3.68	3.69
Results of the Mann–Whitney U significance test, with a significance level of $\alpha = 0.05$								
<i>p</i>		<i>p</i> < 0.001	<i>p</i> < 0.001	<i>p</i> < 0.001	<i>p</i> < 0.001	<i>p</i> < 0.001	<i>p</i> < 0.001	<i>p</i> < 0.001
Statistically significant differences		yes	yes	yes	yes	yes	yes	yes
Attitude toward sustainable development and environmentally friendly practices								
	Mean							
Enthusiast	2.27	2.14	2.24	2.18	2.52	2.22	2.44	2.13
Active	2.62	2.40	2.76	2.53	2.83	2.53	2.73	2.56
Passive	3.00	2.78	3.19	2.99	3.10	3.04	2.95	2.96
Skeptic	3.88	3.82	3.97	3.90	3.93	3.95	3.82	3.79
Critic	3.79	3.87	3.85	3.76	3.83	3.78	3.72	3.72
Ignorant	4.40	4.39	4.45	4.45	4.45	4.37	4.36	4.35

Table 2. Cont.

	SB1–SB6	SB1	SB2	SB3	SB4	SB5	SB6	SB7
Results of the Kruskal–Wallis significance test at a significance level of $\alpha = 0.05$								
<i>p</i>		$p < 0.001$	$p < 0.001$	$p < 0.001$	$p < 0.001$	$p < 0.001$	$p < 0.001$	$p < 0.001$
Statistically significant differences		yes	yes	yes	yes	yes	yes	yes
Post-hoc test		all except “active” and “enthusiastic”	all	all	all	all except “active” and “enthusiastic”	all except “active” and “enthusiastic”; “active” and “passive”	all

Overall, Polish students’ engagement in SD-related practices falls below average on a scale of 1 to 5, where 1 means “always” and 5 means “never”, the mean rating falls between 3.05 and 3.25. This places them at the “sometimes” level, leaning toward “very rarely”. The most frequently practiced behaviors are SB1, “I sort waste in my household” (mean 3.05), and SB7, “I reduce electricity consumption in my home” (mean 3.09). In contrast, the least frequently practiced behaviors are SB4, “I do not buy unnecessary items just because they are on sale” (mean 3.31), and SB2, “I buy organic food” (mean 3.25).

When analyzing the ratings of individual practices by gender, mean responses differ between women and men. The Mann–Whitney U tests of significance confirm this difference for questions SB1–SB7 with a significance level of $\alpha = 0.05$ (Tables S1–S7)—indicating that the difference is statistically significant. Women use sustainable practices more frequently than men, with a lower mean of 2.93 compared to a mean of 3.38 for men.

Considering differences in the frequency of sustainability-related activities based on high school academic track, the mean is lower for students who graduated from a humanities-focused high school (3.08) than for students from other tracks, such as science (3.18) and natural sciences (3.25). This suggests that these students may engage in eco-friendly practices more frequently. However, the Kruskal–Wallis significance tests at an α level of 0.05 for individual questions yield inconclusive results, indicating statistically significant differences for questions SB1, SB4, and SB6 (Tables S8–S10), but not for the remaining four questions (Tables S11–S14). Post hoc tests for significant differences indicate that students in the humanities differ from those in other fields, though no general conclusions can be drawn on this basis.

Regarding the criterion of student hometown size (measured by population), the mean results show that students living in the small and medium-sized cities are more frequently involved in SD-related activities (mean 3.02). An analysis of the Kruskal–Wallis significance test results shows that the results were significant for five questions (Tables S15–S19) and not significant for two questions (Tables S20 and S21). Post hoc tests indicated that the largest urban areas differ statistically from the small and medium-sized cities.

Considering the criterion “Participation in Environmental Initiatives” the mean suggest that students who participate in such initiatives (mean = 2.15) are more likely to engage in sustainable development practices than those who do not participate (mean = 3.72). The Mann–Whitney U tests of significance confirm this, with a significance level of $\alpha = 0.05$ for all questions (Tables S22–S28).

When analyzing the frequency of sustainable actions based on the criterion “Attitude toward sustainable development and pro-environmental practices”, students who are more

committed are more likely to adopt pro-environmental practices. The mean score for the “ignorant” attitude is 4.40 and decreases as the attitude becomes more pro-environmental (indicating more frequent adoption of such practices). For the “Enthusiast” attitude, the mean score is 2.27. These differences are confirmed by the Kruskal–Wallis significance tests at a significance level of $\alpha = 0.05$ for all questions (Tables S29–S35). Post hoc tests indicate differences between nearly all attitudes.

Separate methods were used to answer RQ3 and RQ4. To verify RQ3, a box-and-whisker plot (Figure 1) showing the mean student responses to the question about factors that would most encourage sustainable behavior adoption was used.

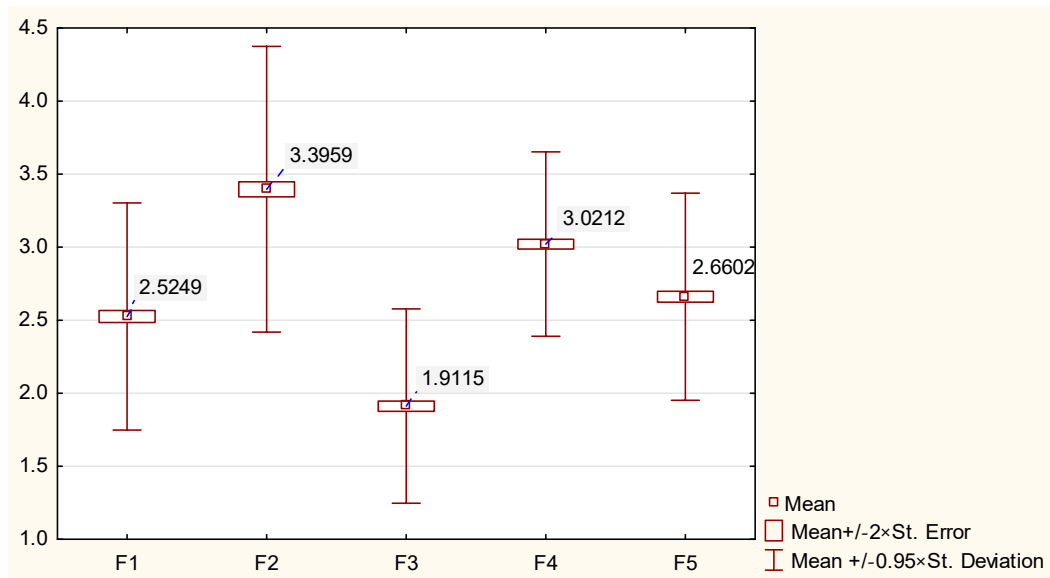


Figure 1. Mean responses to questions F1–F5.

According to the students, the most important factor for encouraging the adoption of sustainable development practices is “Financial Benefits” (F3; mean 1.91), which falls between “definitely yes” and “rather yes” on the scale presented in Table A1. The factors that would have a moderate impact (at a level of 2.5), that is those belonging to the “rather yes” and “hard to say” categories are “Promoting eco-friendly practices and attitudes in lectures and seminars” (F1) and “Education through participation in local environmental projects” (F5). In contrast, the factors deemed to be the least effective by the students are “Online campaigns, social media initiatives, and influencer opinions” (F2), with an average score of 3.40 indicating “hard to say” or “rather not”, and “Organizing meetings/seminars with entities that employ ‘green’ practices (green storytelling)” (F4), with an average score of 3.02 indicating that these activities belong to “hard to say” category.

To answer RQ4, structural equation modeling (SEM) was applied in accordance with the assumptions described in Section 3. The results of this analysis are presented in the model diagram (Figure 2).

The model demonstrates that factor F1 is the only factor with a statistically significant and positive path coefficient (0.684 *) for the latent variable “sustainable behaviors”. This indicates that students for whom the factor “Promoting pro-environmental practices and attitudes in lectures and seminars” is less motivating (higher F1 values) are less likely to engage in sustainable development practices (higher “Sustainable Behaviors” values). Conversely, the more this factor is encouraged (lower F1 values), the more likely students are to engage in eco-friendly behaviors. The remaining factors (F2–F5) are not statistically significant. The results of the model calculations are presented in Table A5.

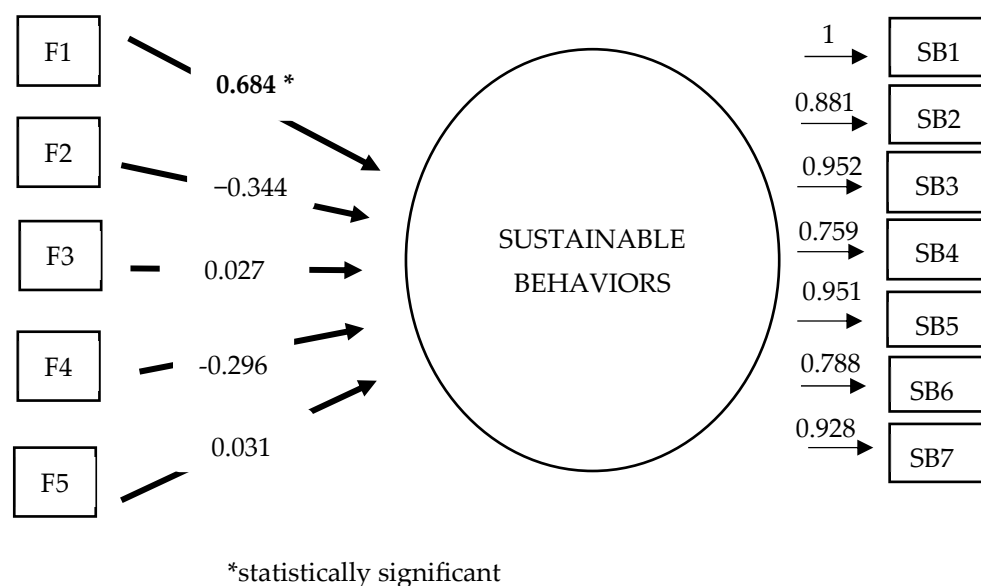


Figure 2. Structural model.

Table 3 summarizes the research findings regarding the answers to RQ3 and RQ4.

Table 3. Declared and actual factors motivating students to adopt sustainable behaviors.

Motivating Factor	Declared Factor	Actual Factor
F1	Average (rather yes/hard to say)	A statistically significant, positive path coefficient
F2	Weak (hard to say/probably not)	Statistically insignificant
F3	Strong (definitely yes/rather yes)	Statistically insignificant
F4	Weak (hard to say)	Statistically insignificant
F5	Average (rather yes/hard to say)	Statistically insignificant

As illustrated in Table 3, the most effective factor for encouraging students to adopt sustainable behaviors is financial benefits (F3), followed by “Promoting pro-environmental practices and attitudes in lectures and seminars” (F1) and “Education through participation in local environmental projects” (F5). However, it is evident that the only factor that prompts respondents to engage in environmentally friendly activities is F1: “Promoting environmentally friendly practices and attitudes in lectures and seminars”.

5. Discussion

The findings of our research indicate that management students in Poland demonstrate limited engagement in sustainable practices, as the application of these practices was occasional, infrequent, or non-existent among the respondents. These observations are consistent with the results of studies conducted in other regions, including Europe [46,50], South America [47,48], and Asia [49]. The most prevalent practices among young individuals in Poland and other countries encompass private-sphere actions such as waste sorting, conserving electricity, utilizing public transportation, and acquiring eco-friendly products [40,44,49,51–53,56].

Our research has demonstrated that women exhibit a higher propensity to engage in sustainable practices when compared to men which is corroborated by studies conducted not only in other European countries, including Finland, Sweden, Poland, Denmark, and

Lithuania [46], but also in countries outside of Europe, such as Jordan [60], Peru [48,61], India [62,63], and Japan [64].

The findings of the present study demonstrate that when examining the determinants of place of residence, students from smaller towns were found to be more likely to engage in SD-related activities than their peers from larger cities. These results contrast with those previously reported by [65–68]. This discrepancy may be attributed to students from smaller towns being in closer proximity to nature and having easier access to organic products and less convenient access to large shopping centres, which tend to offer unhealthy fast food and single-use plastic packaging.

For Polish students, participation in pro-environmental activities and attitudes toward SD differentiate engagement in sustainable practices generally, the more favorable the attitude toward pro-environmental practices, the more frequently they are performed. These findings are consistent with results obtained in other countries including Portugal [69], Albania [70], Iran [64], Indonesia [23], and Vietnam [71]. Our findings align with the KAP model's assumption that attitude influences behavior, as well as the VBN and TBP theories assumption that attitude is one of the foundations of behavioral intention and that participation in pro-environmental actions reflects a sense of self-efficacy.

An analysis of students' motivations for sustainable behavior revealed discrepancies between stated and actual motivators (see Table 3). The only factor that was both a stated and an actual motivator was the promotion of environmentally friendly practices and attitudes in lectures and seminars (see Table 3) which is consistent with the results reported in other studies [105–109]. However, the most effective stated motivator was financial gain, which in reality had no impact on young people's behavior. Although research findings from other countries indicate that financial benefits are a significant motivator for students [110–113], in the Polish context, students are largely financially supported by their parents, so economic motives are not as important to them. This relates to sociocultural differences, which have also been highlighted by other researchers [40,91,98].

The findings of this study serve to further the extant body of knowledge that is VBN theory. The respondents to this study identified educational activities, such as the promotion of eco-friendly practices and attitudes in lectures and seminars, as the most effective approach, rather than, for example, financial benefits. This may be indicative of students' expectations that universities will identify and reinforce pro-environmental values that can convince them of the need to take specific actions and build personal norms (an internal sense of moral obligation) that will effectively encourage them to engage in the desired activities. In contrast, financial benefits are a superficial and short-lived incentive that does not foster internal moral values. The findings of this study also represent a significant contribution to GFT, as the normative goal takes precedence over the goal of financial benefits. Students expect universities to provide appropriate incentives and foster pro-social values, a point emphasized by many of the cited authors [9,23,26,28,43,59,94].

It is interesting to note that students do not perceive contemporary forms of media communication as an effective means of promoting and encouraging pro-environmental actions. However, numerous studies have highlighted the high effectiveness of SD campaigns on the internet and on social media [114–116], especially in regard to young people pro-environmental actions on a personal level [117,118]. This can be explained by the fact that students (as young people) do not view activities such as online campaigns, social media initiatives, or influencers opinions as a means of promoting educational content, including those related to environmental protection but rather associate this content with traditional forms of teaching in schools and universities. Agboola, Ilke, and Mislal Al-sharif [107] demonstrated that incorporating SD into university curricula increases students' environmental awareness and pro-environmental behaviors. Although the internet and

social media are widely recognized as powerful tools for social communication, they often prove to be unreliable and require a critical approach [119,120].

Our research has demonstrated that Polish students do not perceive a motivation to engage in pro-environmental actions including “Organizing meetings/seminars with entities that employ ‘green’ practices (green storytelling)” and “Education through participation in local environmental projects” despite perceiving these as effective determinants. This discrepancy may be attributed to a lack of awareness or opportunity to engage in these activities. While students acknowledge the significance of academic education in shaping their sustainable behaviors they express a desire for more appealing curricula, more engaging forms and types of classes, and greater involvement from faculty members. Other researchers have reached similar conclusions advocating for the introduction of new degree programs and the incorporation of new courses into curricula, the fostering of a culture of environmental responsibility, and greater institutional support for student-led, pro-environmental initiatives [50,83,121–123]. In turn, researchers from the U.S. and Canada have found that a lack of institutional support (e.g., inconsistent recycling systems, plastic tableware in cafeterias) causes many students to abandon the sustainable practices they had previously adopted [124].

The results of our research largely align with global trends and patterns of sustainable behavior among students. Generally, young people engagement in eco-friendly practices is low or moderate [46,48–50] and is primarily carried out at the private level rather than the public level [51–56].

The fact that Polish students identified the promotion of pro-environmental practices and attitudes in lectures and seminars as the most effective incentive for adopting sustainable behaviors suggests that academic education plays a key motivational role. This is consistent with the suggestions of many international authors [60,121,125–129]. The convergence of our research findings with global trends confirms their international dimension, indicating that the mechanisms motivating Polish students towards sustainable behaviors are consistent with those shaping such behaviors worldwide.

6. Conclusions

In this study we set out to ascertain the factors and educational activities that would most effectively encourage students to increase their sustainable behaviors.

The responses to our four research questions served to achieve this objective. In response to the first research question (RQ1), it was found that Polish students’ level of engagement in sustainable practices is below average (falling on the “sometimes” end of the scale, with a tendency toward “very rarely”). Regarding the second research question (RQ2) our results demonstrated the following:

- Women are more likely to engage in sustainable practices than men;
- Students living in small and medium-sized cities are more likely to engage in sustainable activities than those in large metropolitan areas;
- Students who have participated in environmental campaigns and declare a more committed attitude toward SD issues are more likely to engage in sustainable practices.

Regarding RQ3 and RQ4, our research revealed that although the factor most frequently cited by respondents as encouraging sustainable behavior was financial benefit, the actual factor (i.e., the one positively correlated with the most frequently adopted practices) turned out to be “Promoting pro-environmental practices and attitudes in lectures and seminars”.

Our research and analysis enabled our objectives to be achieved and research gaps to be filled, both theoretical and empirical. The theoretical gap concerned the identification of a behavioral paradox, i.e., the discrepancy between stated and actual motivators

of pro-environmental behavior. The empirical gap was addressed by analyzing which factors actually (rather than merely theoretically) encourage students to engage in pro-environmental behavior.

Our study has theoretical, practical, and social implications.

The findings and conclusions presented here offer new insights into the factors that influence student engagement in sustainable practices, inspiring further exploration in this area. Our research enriches theories of motivation, such as PMT, TPB, and the KAP model highlighting the importance of economic, social, and educational motivations for students.

Practical implications include recommendations for administrators at academic institutions and campus leaders. These recommendations highlight the need to modify and develop curricula that incorporate SD in order to strengthen the conversion of pro-environmental attitudes into sustainable practices and behavioral patterns among young people. New courses, teaching formats, and initiatives should be introduced to motivate students to take more action in the public sphere as well as on a personal level. To this end, higher education institutions should develop partnerships with non-governmental organizations, public benefit institutions, and non-profit organizations to motivate students and foster positive experiences. Thus, this research aligns with the implementation of SDG4 (Quality Education) [130].

Our research also has social implications as it highlights the importance of eco-friendly actions and behavioral patterns among students—the future managers, engineers, and specialists—to academic communities. Regarded as leaders and agents of change, young, educated people can set a good example in their workplaces and personal lives, contributing to the spread of sustainable practices in society.

Every study has its limitations, and ours is no exception. Although our study focuses solely on Poland, it offers a broad nationwide perspective and a specific, subject-based sample of management students at technical universities making it a solid basis for international comparisons across various contexts.

Taking into account the noted limitations and the evolving nature of the issues discussed in this article, the following directions for future research are proposed:

- Comparative studies of the motivation for SD actions among students in other fields (e.g., humanities, natural sciences, economics);
- Examinations of the motivations behind students' environmentally friendly behaviors in the public sphere compared to their behaviors in the private sphere;
- Deepening and broadening research to include other motivational factors (e.g., distinguishing between internal and external factors);
- Examinations whether and how universities adapt their fields of study, curricula, and educational strategies to effectively motivate students to engage in SD actions at both the individual (private) and public levels.

Our studies may also inspire the use of other causal methods or mixed methods (quantitative and qualitative) and the development of more complex models.

Supplementary Materials: The following supporting information can be downloaded at: <https://www.mdpi.com/article/10.3390/su18147062/s1>, Table S1. Mann–Whitney U test results for variable SB1 with respect to the grouping variable “Gender”, Table S2. Mann–Whitney U test results for variable SB2 with respect to the grouping variable “Gender”, Table S3. Mann–Whitney U test results for variable SB3 with respect to the grouping variable “Gender”, Table S4. Mann–Whitney U test results for variable SB4 with respect to the grouping variable “Gender”, Table S5. Mann–Whitney U test results for variable SB5 with respect to the grouping variable “Gender”, Table S6. Mann–Whitney U test results for variable SB6 with respect to the grouping variable “Gender”, Table S7. Mann–Whitney U test results for variable SB7 with respect to the grouping variable “Gender”,

Table S8. Kruskal–Wallis ANOVA test results for variable SB1 with respect to the grouping variable “High school profile”, Table S9. Kruskal–Wallis ANOVA test results for variable SB4 with respect to the grouping variable “High school profile”, Table S10. Kruskal–Wallis ANOVA test results for variable SB6 with respect to the grouping variable “High school profile”, Table S11. Kruskal–Wallis ANOVA test results for variable SB2 with respect to the grouping variable “High school profile”, Table S12. Kruskal–Wallis ANOVA test results for variable SB3 with respect to the grouping variable “High school profile”, Table S13. Kruskal–Wallis ANOVA test results for variable SB5 with respect to the grouping variable “High school profile”, Table S14. Kruskal–Wallis ANOVA test results for variable SB7 with respect to the grouping variable “High school profile”, Table S15. Kruskal–Wallis ANOVA test results for variable SB2 with respect to the grouping variable “Place of residence”, Table S16. Kruskal–Wallis ANOVA test results for variable SB4 with respect to the grouping variable “Place of residence”, Table S17. Kruskal–Wallis ANOVA test results for variable SB5 with respect to the grouping variable “Place of residence”, Table S18. Kruskal–Wallis ANOVA test results for variable SB6 with respect to the grouping variable “Place of residence”, Table S19. Kruskal–Wallis ANOVA test results for variable SB7 with respect to the grouping variable “Place of residence”, Table S20. Kruskal–Wallis ANOVA test results for variable SB1 with respect to the grouping variable “Place of residence”, Table S21. Kruskal–Wallis ANOVA test results for variable SB3 with respect to the grouping variable “Place of residence”, Table S22. Mann–Whitney U test results for variable SB1 with respect to the grouping variable “Participation in an environmental campaign”, Table S23. Mann–Whitney U test results for variable SB2 with respect to the grouping variable “Participation in an environmental campaign”, Table S24. Mann–Whitney U test results for variable SB3 with respect to the grouping variable “Participation in an environmental campaign”, Table S25. Mann–Whitney U test results for variable SB4 with respect to the grouping variable “Participation in an environmental campaign”, Table S26. Mann–Whitney U test results for variable SB5 with respect to the grouping variable “Participation in an environmental campaign”, Table S27. Mann–Whitney U test results for variable SB6 with respect to the grouping variable “Participation in an environmental campaign”, Table S28. Mann–Whitney U test results for variable SB7 with respect to the grouping variable “Participation in an environmental campaign”, Table S29. Kruskal–Wallis ANOVA test results and post hoc tests for variable SB 1 with respect to the grouping variable “Attitude toward sustainable development and environmentally friendly practices”, Table S30. Kruskal–Wallis ANOVA test results and post hoc tests for variable SB2 with respect to the grouping variable “Attitude toward sustainable development and environmentally friendly practices”, Table S31. Kruskal–Wallis ANOVA test results and post hoc tests for variable SB3 with respect to the grouping variable “Attitude toward sustainable development and environmentally friendly practices”, Table S32. Kruskal–Wallis ANOVA test results and post hoc tests for variable SB4 with respect to the grouping variable “Attitude toward sustainable development and environmentally friendly practices”, Table S33. Kruskal–Wallis ANOVA test results and post hoc tests for variable SB5 with respect to the grouping variable “Attitude toward sustainable development and environmentally friendly practices”, Table S34. Kruskal–Wallis ANOVA test results and post hoc tests for variable SB6 with respect to the grouping variable “Attitude toward sustainable development and environmentally friendly practices”, Table S35. Kruskal–Wallis ANOVA test results and post hoc tests for variable SB7 with respect to the grouping variable “Attitude toward sustainable development and environmentally friendly practices”.

Author Contributions: Conceptualization, D.S. and A.R.; methodology, D.S. and A.R.; validation D.S. and A.R.; formal analysis, D.S. and A.R.; investigation, D.S. and A.R.; data curation, D.S. and A.R., writing—original draft preparation, D.S. and A.R.; visualization, D.S. and A.R. All authors have read and agreed to the published version of the manuscript.

Funding: Silesian University of Technology (Poland), grant number BK-270/ROZ1/2026 (13/010/BK_26/0093).

Institutional Review Board Statement: Silesian University of Technology; Resolution No. 11/25 of the Ethics Committee for Scientific Research Involving Human Subjects, dated 28 November 2025: The Committee issued a positive opinion on the scientific research study entitled Nationwide Survey

of Knowledge and Awareness of Sustainable Development. This manuscript uses the results of this study.

Informed Consent Statement: The research was commissioned by a professional external company. Before the survey began, each respondent had to read and agree to the participant consent clause regarding participation in the study and processing of personal data. After giving their consent, respondents could proceed in answering the survey questions.

Data Availability Statement: The research data can be provided upon request to the corresponding author.

Conflicts of Interest: The authors declare no conflicts of interest.

Appendix A

Table A1. Questions with answer scale and personal details.

Questions	Responses (Scale)				
Sustainable behaviors					
SB1 I sort waste in my household	1 always	2 very often	3 sometimes	4 very rarely	5 never
SB2 I buy organic food (bio)	1 always	2 very often	3 sometimes	4 very rarely	5 never
SB3 I reduce my home’s water consumption by taking shorter showers and using the dishwasher	1 always	2 very often	3 sometimes	4 very rarely	5 never
SB4 I don’t buy things I don’t need just because they’re on sale	1 always	2 very often	3 sometimes	4 very rarely	5 never
SB5 I avoid buying products intended for one-time use, such as plastic cutlery, straws, and plastic bags	1 always	2 very often	3 sometimes	4 very rarely	5 never
SB6 I use public transportation, a bicycle, an electric scooter, or I walk instead of driving a car	1 always	2 very often	3 sometimes	4 very rarely	5 never
SB7 I reduce my home’s electricity consumption by using energy-saving light bulbs and energy-efficient appliances	1 always	2 very often	3 sometimes	4 very rarely	5 never
Factors encouraging sustainable behavior					
F1 Promoting environmentally friendly practices and attitudes in university lectures and classes	1 definitely yes	2 rather yes	3 it’s hard to say	4 rather not	5 definitely not
F2 Online campaigns, social media activity, and influencer reviews	1 definitely yes	2 rather yes	3 it’s hard to say	4 rather not	5 definitely not
F3 Financial benefits include free bicycle transportation and savings on electricity, gas, and water bills	1 definitely yes	2 rather yes	3 it’s hard to say	4 rather not	5 definitely not
F4 Organize meetings and seminars with entities that use green practices (green storytelling)	1 definitely yes	2 rather yes	3 it’s hard to say	4 rather not	5 definitely not
F5 Education through participation in local environmental projects, such as building urban gardens, planting trees, and measuring traffic intensity and air pollution	1 definitely yes	2 rather yes	3 it’s hard to say	4 rather not	5 definitely not

Table A1. *Cont.*

Questions	Responses (Scale)					
Personal details						
Gender	Female			Male		
High school profile	exact sciences		humanities	natural sciences		
Place of residence (number of residents)	up to 20,000	20,000 to 50,000	50,000 to 150,000	150,000 to 500,000		over 500,000
Participation in environmental campaign	Yes			No		
Attitude toward sustainable development and environmentally friendly practices	Enthusiast	Active	Passive	Skeptic	Critic	Ignorant

Table A2. Skewness and kurtosis of variables SB1–SB7 and F1–F5.

Variables	Skewness	Kurtosis
SB1	−0.081	−1.346
SB2	−0.243	−1.072
SB3	−0.139	−1.231
SB4	−0.193	−0.926
SB5	−0.15	−1.215
SB6	−0.126	−1.083
SB7	−0.076	−1.198
F1	0.661	0.464
F2	−0.289	−0.336
F3	1.28	3.870
F4	0.411	3.136
F5	−0.17	1.010

Table A3. Model fit measures.

Goodness-of-Fit Index	A Model with Observed Data for Endogenous and Exogenous Variables	A Model with Two Latent Variables (for Endogenous and Exogenous Variables)	A Mixed Model with a Single Latent Variable (the Latent Variable is Endogenous) and Exogenous Variables as Observed Variables	Standards for a Good Model Fit
RMS standardized residuals	0.421	0.0372 *	0.0252 *	<0.05
GFI	0.376	0.967	0.979	>0.95
AGFI	−0.872	0.948	0.962	>0.95
Standardized Bentler-Bonett Index	0.057	0.963	0.975	>0.90
Unstandardized Bentler-Bonett index	−1.405	0.958	0.971	>0.95
McDonald's Noncentrality Index	0.016	0.917	0.950	>0.90
RMSEA Steiger-Lind	0.566	0.059	0.048	<0.05
Population Gamma Index	0.419	0.972	0.983	>0.95
Adjusted Population Gamma Index (APGI)	−0.743	0.955	0.970	>0.95

* statistically significant.

Table A4. Model reliability measures.

	Loadings	St. Error.	CR	Decision	AVE	Decision
(sustainable behavior) → [SB1]	1.000					
(sustainable behavior)-1 → [SB2]	0.881	0.023				
(sustainable behavior)-2 → [SB3]	0.952	0.024				
(sustainable behavior)-3 → [SB4]	0.759	0.022	0.9943	>0.7 high reliability	0.8880	>0.5 high reliability
(sustainable behavior)-4 → [SB5]	0.951	0.024				
(sustainable behavior)-5 → [SB6]	0.788	0.024				
(sustainable behavior)-6 → [SB7]	0.928	0.024				

Table A5. Evaluation of the structural model.

Model-Paths	Path Coeff.	St. Error.	t Stat.	p-Value
(F1)-1 → (sustainable behavior)	0.684 *	0.242 *	2.826 *	0.005 *
(F2)-2 → (sustainable behavior)	−0.344	0.283	−1.215	0.224
(F3)-3 → (sustainable behavior)	0.027	0.357	0.076	0.940
(F4)-4 → (sustainable behavior)	−0.296	0.208	−1.423	0.155
(F5)-5 → (sustainable behavior)	0.031	0.062	0.491	0.623

* statistically significant.

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