Opportunities and Challenges in Sustainability
https://www.acadlore.com/journals/OCS

Modeling the Influences on Sustainable Attitudes of Students Towards Environmental Challenges: A Partial Least Squares-Structural Equation Modelling Approach

Sinan Saraçlı[1*], Berkalp Tunca[2], İsa Gül[3], Erkan Arı[4], Bilge Villi[5], Buket İpek Berk[6], İhsan Berk[6], Gratiela Dana Boca[7]

[1] Department of Biostatistics, Balikesir University, 10145 Balikesir, Turkey
[2] Department of Statistics, Eskisehir Osmangazi University, 26040 Eskisehir, Turkey
[3] Department of Health Management, Afyonkarahisar Health Sciences University, 03030 Afyonkarahisar, Turkey
[4] Department of Econometrics, Dumlupinar University, 43100 Kutahya, Turkey
[5] Department of Management and Organization, Balikesir University, 10145 Balikesir, Turkey
[6] Department of Biostatistics, Sanko University, 27090 Gaziantep, Turkey
[7] Department of Economics, Technical University of Cluj Napoca, 430122 Baia Mare, Romania

[*] Correspondence: Sinan Saraçlı (ssaracli@balikesir.edu.tr)

Received: 08-10-2023 **Revised:** 08-25-2023 **Accepted:** 09-20-2023

Citation: Saraçlı, S., Tunca, B., Gül, I., Arı, E., Villi, B., Berk, B. I., Berk, I., & Boca, G. D. (2023). Modeling the influences on sustainable attitudes of students towards environmental challenges: A partial least squares-structural equation modelling approach. *Oppor Chall. Sustain.*, *2*(3), 161-171. https://doi.org/10.56578/ocs020305.

Abstract: To assess sustainable attitudes towards environmental issues, understanding the most impactful variables amongst sub-dimensions of attitudes proves critical. In this research, the subdimensions of attitudes of students towards environmental challenges were modelled. An online Likert-scale questionnaire, spanning from 1 'Strongly Disagree' to 5 'Strongly Agree', was administered to 380 high school and associate degree students in Afyonkarahisar city center between 15 September and 15 November 2022. The questionnaire aimed to gauge the students' attitudes using the Affective, Cognitive, and Behavioural sub-dimensions. Results revealed a statistically significant effect coefficient of 0.557 between the cognitive and affective attitudes. In a similar vein, the cognitive attitude's impact on behavioural attitude was found to be statistically significant with an effect coefficient of 0.534. However, a coefficient of 0.017 between affective and behavioural attitudes demonstrated no statistically significant mediator effect. Contrary to the initial hypotheses surrounding the mediator effect of affective attitude on behavioural attitude, the findings indicate that cognitive and affective attitudes independently influence behavioural attitude. Within the cognitive dimension, the awareness of the escalating environmental problems emerged as a paramount item. It is implied that for fostering sustainable environmental behaviour, the cognitive dimension plays a pivotal role.

Keywords: Sustainable attitude; Environmental challenges; Environmental sensitivity; Environmental behaviour; Partial Least Squares-Structural Equation Modelling (PLS-SEM); Statistical modelling

1. Introduction

Over recent years, heightened awareness has been generated concerning the severe threats environmental challenges pose to urban regions. Among these looming threats are issues jeopardising the longevity of pivotal environmental resources such as nature reserves, open spaces, floodplains, water assets, and natural parks. From these environmental predicaments, outcomes such as intensified heat waves, droughts, augmented flooding, and heavier precipitation have been reported, potentially exacerbated by rapid urbanisation and shifting climatic conditions. Concurrently, threats to urban zones and their infrastructural integrity have been identified. Notably, escalating pressures on public domains, rising structural degradation risks under the guise of natural area developments, compromised water buffer systems, and amplifying demands for emergency response and

associated services have been highlighted (Cobbinah et al., 2017; Korah & Cobbinah, 2016; Mpofu, 2013; Quagraine, 2011; WHO, 2013).

Sustainable development, a cornerstone in addressing environmental dilemmas, has been established as one of the EU's core strategies (News Waste Recycling European Environment Agency, 2023). It has been documented that nearly a third of Europe's plastic waste undergoes recycling. Additionally, a sharp rise in global plastic production has been recorded, surging from 1.5 million tons in 1950 to a staggering 359 million tons in 2018 (Actualitate Parlamentul European, 2023; Boca & Saraçli, 2023).

Efforts to curtail environmental degradation have been primarily achieved by emphasising environmental advantages throughout consumption processes. The act of procuring recyclable or ecologically benign products from environmentally considerate companies is often perceived as an emblem of positive environmental behaviour (Saraçlı et al., 2014).

The term "sustainable development", although conceptually beneficial, presents global challenges. Recent dominant economic growth paradigms globally have been discerned as catalysing tensions concerning environmental preservation. A heightened conflict between sustainable development goals (SDGs) and economic growth has been observed, primarily driven by excessive energy and material consumption leading to augmented emissions. An emergent objective in this discourse has been to enrich educational curricula with sustainable development principles, fostering avenues for individuals to champion sustainability (Saraçlı, S. & Boca, 2021).

A comprehensive understanding of environmental behaviour mandates consideration of both the costs and benefits of environmental actions, alongside prevailing attitudes towards the environment (Deacon & Shapiro, 1975; Kahn & Matsusaka, 1997; Kahn, 2002; Sciarini et al., 2007). Investigations into the nexus between environmental attitudes and consequent actions have been voluminous, predominantly underpinned by focused case studies. It has been posited by studies such as those of Kahn (2002) and Baldassare & Katz (1992) that environmental matters deeply influence consumer decisions, as seen in choices like opting for hybrid vehicles, utilising public transport, or curtailing gasoline consumption. Furthermore, these issues also shape specific environmental practices like recycling and water conservation.

In a geographically specific study, Vaske & Donnelly (1999) revealed, through mapping voting predilections regarding wildlife conservation in Colorado, USA, that value orientations were profoundly influenced by prevailing attitudes, which in turn steered behavioural intentions. Interestingly, findings from Butler & Francis (1997) indicated that environmental attitudes even permeate areas as distinct as women's clothing purchase decisions. This connection between environmental attitudes and a myriad of environmental behaviours has been substantiated across various nations and demographic subsets (Blake, 2001; Casaló& Escario, 2018; Cottrell, 2003; Holbert et al., 2003; Levine & Strube, 2012; Scott & Willits, 1994). Political voting has been interpreted by some as a manifestation of environmental action. In this vein, electorates have been observed to favour political factions proposing environmental resolutions in locales as diverse as California, Colorado, New Jersey, Belgium, New Zealand, Australia, Germany, and others (Boonen et al., 2014; Edwards & Lomax, 2012; Gauja & Jackson, 2016; Gill et al., 1986; Papp, 2022; Rüdig, 2012; Rudman et al., 2013).

Although a direct correlation between environmental knowledge and environmental education has not been consistently affirmed, it has been observed that alterations in environmental decision-making processes can occur (Hungerford & Volk, 1990). In this discourse, it has been proposed that environmental behaviours might be shaped by an amalgamation of behaviour, attitude, and knowledge. Further, evidence suggests that refining these behaviours necessitates modifications in educational paradigms (Heimlich & Ardoin, 2008; Hines et al., 1987). Yet, gauging the interplay between behaviour, attitude, and knowledge has been acknowledged as challenging (Cincera, 2019). As a result, certain inquiries have exclusively probed the interrelation between environmental attitudes and behaviours (Hungerford & Volk, 1990). Another dimension to this discourse is the influence of "culture" on environmental outlooks. Pioneers in the cultural domain such as Bogner (2002), Buttefield (1965), Giddens (2012), and Stern (2000) have underscored that, within a societal milieu, the impact of cultural nuances on environmental behaviours and attitudes cannot be sidelined (Saraçlı & Boca, 2021).

The imperative of accentuating the roles of environmental educators and the encompassing realm of environmental education emerges from the need to mitigate, and ideally nullify, the adverse anthropogenic impacts on the environment. A foundational goal of environmental education is the inculcation of apt behaviours and actions, orchestrated towards the resolution of environmental quandaries and the amplification of environmental cognizance (Milton et al., 1995). Disconcertingly, it has been elucidated that prevailing traditional methodologies do not adequately bolster the environmental consciousness of individuals nor effectively address the mitigation of environmental issues (Artun & Okur, 2015; Çimen & Yılmaz, 2014; D'Amato & Krasny, 2011; Feinstein, 2004; Uyanık, 2016; Wynveen et al., 2011).

In response to these findings, contemporary approaches to environmental education have been fervently explored. Novel learning paradigms are continuously being conceptualised and incorporated, with a focus on augmenting environmental knowledge and positively refining attitudes and behaviours directed towards the environment. Generally, the overarching intent of environmental education is not merely to endow students with knowledge and skills, but also to imbue them with awareness and to capacitate them in actively partaking in

environmental preservation endeavours. It has been postulated by Atasoy (2006) that the pursuit of environmental education is the positive transformation of individual attitudes and behaviours. Within the spectrum of adult education, the gravitas of creating or attributing meaning is paramount. It is through self-reflection and critical analysis that actions are cultivated within the societal matrix, thereby deriving significance from experiential episodes (Mezirow, 1994). Attempts have been made to discern the impact of environmental knowledge upon environmental behaviours. An emergent consensus among researchers indicates that unsustainable behaviours often stem from a dearth of environmental knowledge coupled with a disregard for the ramifications of one's actions (Sakçı & Uyanık, 2023; Williamson & Lynch-Wood, 2001).

In light of the extant environmental challenges and the environment's responses, especially within the ambit of the research question-"Affective and Cognitive Attitudes effects Behavioral Attitude"-this study is poised to architect a model detailing the multifaceted attitudes of high school and associate degree students vis-à-vis environmental issues, offering a nuanced perspective.

2. Methodology

In assessing the attitudes of students, demarcated by the Affective, Cognitive, and Behavioural subdimensions, a Likert-scale online questionnaire was employed. The scale ranged from 1, representing 'Totally Disagree', to 5, signifying 'Totally Agree'. This questionnaire was administered to a cohort of 380 high school and associate degree students, selected through a random sampling technique, in the city centre of Afyonkarahisar from 15 September to 15 November 2022.

For the formulation of the questionnaire, the attitude scale towards environmental problems delineated by Kılıç & Kan (2020) was utilised. A noteworthy proportion of these questionnaires was returned incomplete; thus, subsequent analyses were conducted based on the 298 adequately completed ones. The study, in alignment with the Declaration of Helsinki, was sanctioned by the Ethics Committee of Afyon Kocatepe University (Date: 21/06/2022, No: 2022/18). Informed consent was procured from all participating subjects.

The data accrued for this study were subjected to various analytical techniques, including descriptive statistics, factor analysis, validity and reliability analysis, and PLS-SEM. Analyses were executed utilising the SPSS and SmartPLS software tools. Though the selection of an optimal statistical technique for particular data sets poses challenges for many researchers, it is imperative to align with the research problem and hypotheses at hand. Given the objectives of this study and its associated hypotheses, SEM was discerned as the singularly apt statistical technique for modelling inter-dimensional relationships and pinpointing influential elements within each dimension, accompanied by their coefficients. SPSS, a widely recognised statistical software, rendered detailed results for both descriptive statistics and Explanatory Factor Analysis, while SmartPLS provided the requisite modelling and coefficient findings, thus elucidating the statistical interpretations.

SEM stands as a rigorous statistical methodology, integral for validating hypotheses regarding causal links between both observed and unobserved (latent) variables. This approach has proven invaluable for addressing complexities inherent to theoretical construction (Reisinger & Turner, 1999; Saraçlı & Ulucan, 2021).

Within the realms of economics and social sciences, SEM is ubiquitously employed, principally owing to its capability to model latent variables, accommodate diverse forms of measurement errors, and empirically test holistic theories. Two primary methods delineate the SEM spectrum: covariance-based SEM and variance-based SEM.

Covariance-based SEM, which employs an empirical variance-covariance matrix for model parameter estimation, is traditionally selected when the model is presumed to encompass one or more common factors. Conversely, variance-based SEM initially formulates proxies as linear combinations of observed variables, subsequently leveraging these proxies for model parameter estimation. Such a method is apt when the model is surmised to integrate composite constructs (Gul et al., 2023; Henseler et al., 2016).

Among the myriad techniques within variance-based SEM, the PLS path model is heralded as the most intricate and adaptive (Hair et al., 2011a; McDonald, 1996). The adoption of PLS analysis has proliferated across disciplines, evidenced in areas such as information systems research, strategic management, and marketing (Hair et al., 2012; Hair et al., 2011b; Marcoulides & Saunders, 2006). Due to its adeptness at modelling constructs, especially in behavioural research, PLS effectively delineates relationships amidst latent variables and potent concepts (Höök & Löwgren, 2012). Such proficiency has positioned PLS analysis as a preeminent tool for modelling intricate factor relationships and assessing their significance (Albers, 2009; Henseler et al., 2016).

In the present study, inspiration was drawn from Gul et al. (2023) in formulating the model depicted in Figure 1.

The ensuing hypotheses pertain to the model portrayed in Figure 1:

H_1: Cognitive Attitude influences Behavioural Attitude.

H_2: Cognitive Attitude impacts Affective Attitude.

H_3: Affective Attitude influences Behavioural Attitude.

H_4: A mediating effect is observed in Affective Attitude on the influence of Cognitive Attitude on Behavioural Attitude.

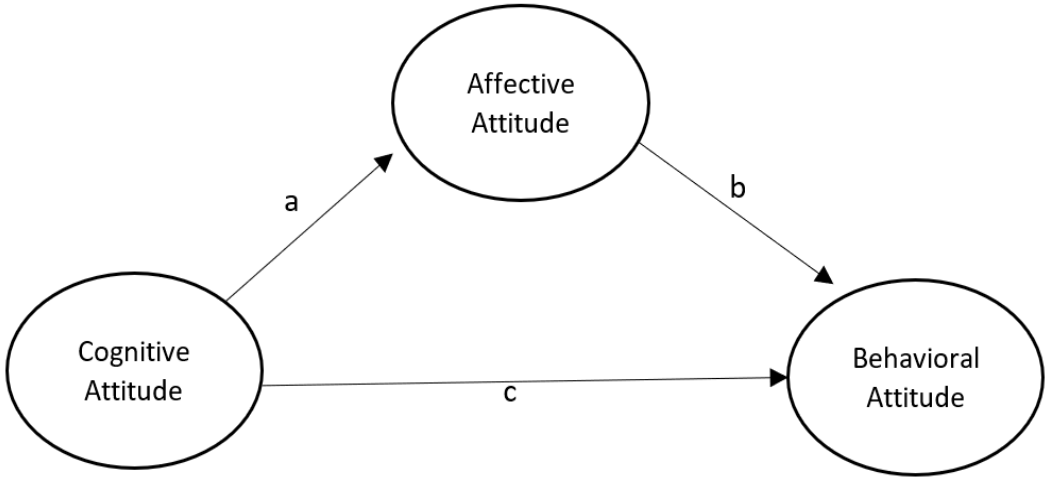

Figure 1. Research model

3. Results

3.1 Descriptive Analysis

Demographic characteristics of the participants were collated, with the variables of gender, age, education level, and parental education levels detailed in Table 1.

Table 1. Detailed demographic profile of participants

Variable	Level	f (Frequency)	% (Percentage)
Gender	Female	191	64.1
	Male	107	35.9
Education level	High School	116	38.9
	Associate degree	182	61.1
Father education level	No formal education	13	4.4
	Primary School	123	41.3
	Middle School	41	13.8
	High School	68	22.8
	Associate degree	49	16.4
Mother education level	No formal education	61	20.5
	Primary School	164	55.0
	Middle School	19	6.4
	High School	33	11.1
	Associate degree	20	6.7

For gender, females were found to represent 64.1% of the sample while males accounted for 35.9%. In the context of educational attainment, 38.9% of the participants had completed high school, and 61.1% had achieved an associate degree.

A scrutiny of the fathers' educational backgrounds revealed that 4.4% had no formal education, 41.3% had completed primary education, 13.8% had concluded middle school, 22.8% were high school graduates, and 16.4% possessed an associate degree. In comparison, for the mothers, 20.5% had no formal education, 55.0% were primary school graduates, 6.4% had finished middle school, 11.1% had concluded high school, and 6.7% had an associate degree. The mean age of the participants was recorded at 38.53 years.

Table 2 provides an exhaustive breakdown of the factors under investigation.

Table 2. Detailed analysis of study factors

Variable	n	Min.	Max.	Mean	Std. Deviation
Affective Dimension	298	1	5	1.38	0.57
Behavioral Dimension	298	1	5	1.95	0.61
Cognitive Dimension	298	1	5	1.39	0.48

The findings related to the affective, behavioural, and cognitive dimensions were summarised from an analysis of 298 participants. For the Affective Dimension, scores ranged from a minimum of 1 to a maximum of 5, with an average score of 1.38 and a standard deviation of 0.57. The Behavioral Dimension scores also ranged from 1 to 5, presenting an average of 1.95 and a standard deviation of 0.61. Lastly, the Cognitive Dimension displayed scores between 1 and 5, with a mean value of 1.39 and a standard deviation of 0.48.

3.2 Validity and Reliability of the Model

To establish convergent validity within the PLS model, three criteria were outlined. Firstly, it is imperative for the standard factor loading of latent variables to exceed 0.5 and to be statistically significant. Secondly, both Composite Reliability (CR) and Cronbach's Alpha (CA) values for each construct should surpass 0.7. Lastly, the Average Variance Explained (AVE) must be greater than 0.5 (Fornell & Larcker, 1981; Hair et al., 1998). Details on the factor loadings, CA, CR, and AVE for the affective, behavioural, and cognitive dimensions are provided in Table 3.

Table 3. Metrics for convergent validity: Factor loadings, CA, CR and AVE values

Item/Dimension	Factor Loadings	CA	CR	AVE
Affective Dimension				
A1. Disposing waste materials into the environment does not upset me.	0.817	0.832	0.878	0.547
A2. Increasing environmental problems does not disturb me.	0.766			
A3. The thought that toxic substances thrown into the environment affect all living things does not scare me.	0.827			
A4. Not being able to prevent environmental problems does not upset me.	0.556			
A5. Thinking that we cannot leave a clean environment to future generations does not worry me.	0.718			
A6. Environmental problems do not affect my health.	0.501			
Behavioral Dimension				
B1. I talk to my friends about what can be done to reduce environmental damage.	0.702	0.793	0.857	0.546
B2. Burnt gases from car exhausts pollute the atmosphere and make me angry.	0.626			
B3. I ask questions around me to find out what causes air pollution.	0.813			
B4. I do research on how to solve environmental problems.	0.736			
B5. I would like to work voluntarily in activities for the protection of the environment.	0.654			
Cognitive Dimension				
C1. I am aware that environmental problems harm all living things.	0.676	0.859	0.891	0.505
C2. I believe that we should live in harmony with our environment.	0.696			
C3. I am worried about the thought that people will suffer the consequences of increasing environmental problems caused by humans.	0.583			
C4. I am aware that environmental problems are getting bigger.	0.710			
C5. I am aware that environmental problems reduce the quality of life.	0.732			
C6. In order to solve environmental problems, I first keep my own environment clean.	0.600			
C7. I feel sad when environmental problems harm living creatures and nature.	0.567			
C8. Increasing deaths of living things due to environmental problems worries me.	0.667			

Upon inspection of Table 3, CR values ranged from 0.793 to 0.859. The AVE values were found to be bracketed between 0.505 and 0.547, signifying adherence to the stipulated criteria.

The discriminant validity of the measurement model was gauged using the Fornell-Larcker criterion. This validity assessment requires the square root of the AVE for each construct to be juxtaposed against inter-construct correlations. A model demonstrates satisfactory discriminant validity when the square root values of AVE surpass their respective correlations (Fornell & Larcker, 1981). The related values are encapsulated in Table 4.

Table 4. Discriminant validity assessment using the Fornell-Larcker criterion

	Affective Dimension	Behavioral Dimension	Cognitive Dimension
Affective Dimension	0.740		
Behavioral Dimension	0.315	0.739	
Cognitive Dimension	0.557	0.544	0.710

In the Fornell-Larcker criterion table, diagonal values indicate the square root of the AVE for each construct, while off-diagonal values depict correlation coefficients between constructs. The model's discriminant validity is deemed established, as the square root of the AVE consistently exceeds the correlation coefficients between constructs.

An alternative approach, the HTMT criterion, which represents the geometric mean of factor correlations, was also employed. This criterion has been identified as potent for values not exceeding 0.90 (Hair et al., 2017). The associated findings are articulated in Table 5.

Table 5. Discriminant validity evaluation using the HTMT criterion

	Affective Dimension	Behavioral Dimension	Cognitive Dimension
Affective Dimension			
Behavioral Dimension	0.380		
Cognitive Dimension	0.650	0.645	

Given that the HTMT values in Table 5 oscillate between 0.380 and 0.650, remaining under the critical threshold of 0.9, the model's discriminant validity is affirmed in line with the HTMT criterion.

3.3 Structural Model Findings

Results derived from the PLS path diagram analysis for the model are depicted in Figure 2.

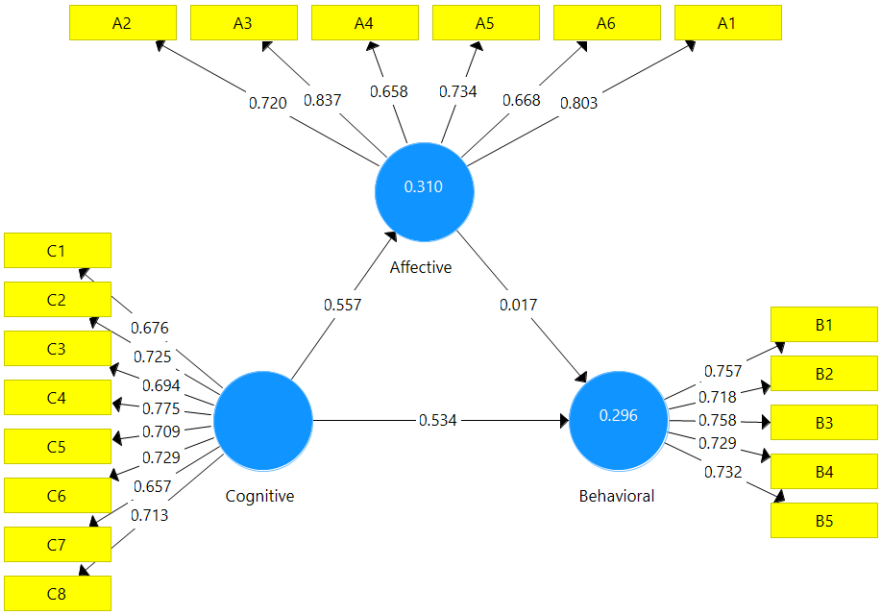

Figure 2. PLS path diagram of the model

Upon assessment of the path coefficients in Figure 2, it was observed that the cognitive component influences the affective component with a positive coefficient of 0.557. Similarly, the cognitive component's impact on the behavioural component is noted with a positive coefficient of 0.534, while the affective component's influence on the behavioural component is indicated by a positive coefficient of 0.017. Parameter estimates, along with the t statistics of the PLS model, are detailed in Table 6.

Table 6. Parameter estimates and T statistics of the PLS model

Hypothesis	Relationship	Parameters (β)	*t*-Statistics	*p*-Values	Decision
H_1	Affective → Behavioral	0.017	0.266	0.790	Not Supported
H_2	Cognitive → Affective	0.557	5.930	0.0001*	Supported
H_3	Cognitive → Behavioral	0.534	7.820	0.0001*	Supported

*p<0.01

Within Table 6, t statistics and p values significant to the model coefficients of Figure 2 are delineated. According to the data, hypothesis H_1 is not supported statistically (p=0.793), whereas hypotheses H_2 and H_3 obtain

statistical validation (p=0.0001). In alignment with these results, coefficients between Cognitive → Affective (0.557) and Cognitive → Behavioural (0.534) were deemed statistically significant.

Table 7. Tabulation of effect sizes (f^2)

Relationship	f^2 Values	Effect Size
Affective → Behavioral	0.000	Rejected
Cognitive → Affective	0.449	Accepted
Cognitive → Behavioral	0.280	Accepted

Using the benchmarks set by Hair et al. (1998), effect sizes were classified as >=0.02 (low), >= 0.15 (medium), and >= 0.35 (strong). An examination of the data from Table 7 revealed the Affective → Behavioural link had an effect size of 0.000, thus signifying no discernible effects. Conversely, the Cognitive → Affective link exhibited a strong effect size of 0.449. Additionally, the Cognitive → Behavioural relationship showed a medium effect size of 0.280, indicating a significant association between cognitive factors and behavioural outcomes.

Assessment of the VIF values revealed measurements of 1.449 between affective and behavioural components, 1.000 between cognitive and affective components, and 1.449 between cognitive and behavioural components. Utilizing the threshold provided by Henseler et al. (2014), wherein a VIF value equal to or exceeding 5 suggests multicollinearity issues, it was deduced that multicollinearity was not a concern in this model.

Table 8 shows the findings regarding the indirect effects of the model given in Figure 2.

Table 8. Indirect effect values within the PLS model

Relationship	Parameters	t- Statistics	p-Value
Cognitive→Affective→Behavioral	0.010	0.225	0.799

The indirect effects were quantified, identifying the "Cognitive -> Affective -> Behavioural" relationship with a value of 0.010. This value insinuates that cognitive variables mildly influence affective variables, which subsequently exert a moderate impact on behavioural outcomes. However, the lack of statistical significance in this indirect effect (p=0.799>0.05) suggests that cognitive variables might not considerably dictate behavioural outcomes and that affective variables might not serve as a mediator in this intricate causal network.

The arrangement and timing of survey items could introduce bias into participant responses, potentially skewing their attitudes, behaviours, and opinions. This phenomenon, termed common method bias, arises when the chosen measurement methodology disproportionately sways research outcomes. Amongst the array of tools available to ascertain common method bias, this study employed Harman's single factor test. Given the finding that a single factor accounted for less than 50% of the explained variance, the research was concluded to be free from common method bias (Podsakoff et al., 2003).

4. Discussion and Conclusion

Integral to the 2030 Agenda for Sustainable Development are the SDGs, comprising 17 distinct targets and 169 specified objectives. These objectives are categorised into five main pillars, colloquially termed the "5Ps". These pillars encompass: (i) People, which encapsulates objectives such as poverty reduction, hunger eradication, provision of quality education, and attainment of gender parity; (ii) Planet, centred on mitigating planetary pollution and endorsing sustainable utilisation of natural resources; (iii) Prosperity, focusing on enhancing individual well-being and nurturing quality life; (iv) Peace, dedicated to fostering equality, fortifying legal institutions, and staving off conflict; and (v) Partnerships, which advocate for collaborative efforts spanning individuals to organisations to achieve the SDGs (Cassar, 2022). The present study zeroes in on the Planet category, underscoring the imperative of fostering sustainable environmental attitudes to safeguard the Earth from degradation.

Previous research indicates that environmental knowledge, in isolation, inadequately predicts environmental behaviour (Hungerford & Volk, 1990). Similar conclusions have been reached in other studies, asserting that mere environmental knowledge does not profoundly influence the cultivation of environmental awareness or environmentally-sensitive behaviours (Artun & Okur, 2015; Çimen & Yılmaz, 2014; Ramsey & Rickson, 1976). This shortfall in sustainable conduct can be attributed to a prevalent lack of environmental awareness, coupled with a disregard for the ramifications of one's actions on the environment (Williamson & Lynch-Wood, 2001).

Research conducted on the influence of environmental knowledge on behaviour has spawned diverse outcomes. While certain studies postulate that environmental knowledge is insufficient in moulding behavioural patterns (Hungerford & Volk, 1990; Ramsey & Rickson, 1976), others propound that multiple determinants, apart from knowledge, shape environmentally-conscious actions (Ajzen, 1991; Hungerford & Volk, 1990; Sakçı & Uyanık, 2023). Noteworthy in this study is the finding that cognitive and affective attitudes independently and distinctly

influence behavioural attitudes. Such a discovery accentuates the notion that, for sustainable environmental behaviours to flourish, an acute cognitive awareness of escalating environmental challenges is paramount.

Further analyses reveal that the item A3, centred on the dangers of environmental toxins, exerts the most pronounced effect on affective attitudes (coefficient: 0.837). In contrast, the item A4, which pertains to the distress caused by unchecked environmental issues, wields the least influence (coefficient: 0.658). Additionally, items C4 and C7, concerning growing environmental problems and their impact on living organisms respectively, influence cognitive attitudes the most and least (coefficients: 0.775 and 0.657). Regarding behavioural attitudes, item B3, which delves into inquiries about air pollution sources, manifests the highest effect (coefficient: 0.758), while item B2, focusing on vehicular pollution's environmental impact, exhibits the least (coefficient: 0.718).

Statistical analyses highlight that cognitive attitudes significantly impact both affective (coefficient: 0.557) and behavioural attitudes (coefficient: 0.534). However, the influence of affective attitude on behavioural attitude, with a coefficient of 0.017, is deemed statistically insignificant, suggesting that cognitive attitude does not mediate between affective and behavioural attitudes. This underlines the independent effects of both cognitive and affective dimensions on behavioural outcomes.

Given the study's contextual limitations-constrained to high school and associate degree students in Afyonkarahisar-it can be cautiously inferred, bearing in mind demographic similarities, potential implications for broader regions. It is surmised that enhancing educational levels and cultivating a deeper appreciation for environmental preservation for succeeding generations could potentiate sustainable environmental behaviour. Concurrently, it is posited that transitioning away from fossil fuels and reinforcing measures against forest fires are pivotal. With escalating climatic changes and global warming, it becomes increasingly urgent for both individuals and governments to fortify preventive measures. This study underscores the imperative of understanding the root causes of environmental pollution to facilitate these preventative actions.

Author Contributions

Conceptualization, SS.; methodology, S.S., B.T., G.D.B.; software, B.T., İ.G.; validation, SS., BT. and G.D.B; formal analysis, S.S and B.T.; investigation, B.İ.B., İ.B., E.A. and B.V.; resources, GDB and İG.; data curation, S.S.; writing-original draft preparation, SS., and BT. All authors have read and agreed to the published version of the manuscript.

Data Availability

The data used to support the research findings are available from the corresponding author upon request.

Conflicts of Interest

The authors declare no conflict of interest.

References

Actualitate Parlamentul European. (2023). *Plastic waste and recycling in the EU in figures*. https://www.europarl.europa.eu/news/ro/headlines/society/20181212STO21610/deseurile-din-plastic-si-reciclarea-in-ue-in-cifre.

Ajzen, I. (1991). The theory of planned behavior. *Organ. Behav. Hum. Decis., 50*, 179–211. https://doi.org/10.1016/0749-5978(91)90020-T.

Albers, S. (2009). PLS and success factor studies in marketing. In V. Esposito Vinzi, W. Chin, J. Henseler, & H. (Eds) Wang (Eds.), *Handbook of Partial Least Squares, Springer Handbooks of Computational Statistics.* Springer, Berlin, Heidelberg. https://doi.org/10.1007/978-3-540-32827-8_19.

Artun, H. & Okur, M. (2015). Ortaokul öğrencilerinin çevre kavramına yönelik bilgi ve çevreyi anlama düzeylerinin belirlenmesi. *Dicle Univ. Ziya Gokalp Educ. Fac. J., 24*, 277–293. https://doi.org/10.14582/DUZGEF.499.

Atasoy, E. (2006). *Çevre İçin Eğitim-Çocuk Doğa Etkileşimi*. Bursa: Ezgi Kitap Evi. https://www.kitapyurdu.com/kitap/cevre-icin-egitim-cocuk-doga-etkilesimi/77969.html.

Baldassare, M. & Katz, C. (1992). The personal threat of environmental problems as predictor of environmental practices. *Environ. Behav., 24*(5), 602–616. https://doi.org/10.1177/0013916592245002.

Blake, D. E. (2001). Contextual effects on environmental attitudes and behavior. *Environ. Behav., 33*(5), 708–725. https://doi.org/10.1177/00139160121973205.

Boca, G. D. & Saraçli, S. (2023). Effects of Romanian student's awareness and needs regarding plastic waste management. *Sustainab., 15*(8), 6811. https://doi.org/10.3390/su15086811.

Bogner, F. X. (2002). The influence of a residential outdoor education program to pupils environment perception. *J. Psychol. Educ.*, *17*, 19-34. https://doi.org/10.1007/BF03173202.

Boonen, J., Meeusen, C., & Quintelier, E. (2014). The link between social attitudes and voting propensities: Attitude-vote consistency among adolescents in Belgium. *Elect Stud.*, *36*, 81–93. https://doi.org/10.1016/j.electstud.2014.07.002.

Butler, S. M. & Francis, S. (1997). The effects of environmental attitudes on apparel purchasing behavior. *Cloth. Text. Res. J.*, *15*(2), 76–85. https://doi.org/10.1177/0887302X9701500202.

Buttefield, P. G. (1965). *Educational Attitudes and Learning Orientations of Rural Adults in Selected Cultural Settings*. University of Wisconsin, Madison, USA.

Casaló, L. V. & Escario, J. J. (2018). Heterogeneity in the association between environmental attitudes and pro-environmental behavior: A multilevel regression approach. *J. Cleaner Prod.*, *175*, 155–163. https://doi.org/10.1016/j.jclepro.2017.11.237.

Cassar, C. (2022). Addressing transformative education and governance through the sustainable development goal 4: A case study. *Oppor Chall. Sustain.*, *1*(2), 105–115. https://doi.org/10.56578/ocs010203.

Çimen, O. & Yılmaz, M. (2014). Dönüşümsel öğrenme kuramına dayalı çevre eğitiminin biyoloji öğretmen adaylarının çevre sorunlarına yönelik algılarına etkisi. *Bartin Univ. Educ. Fac. J.*, *3*(1), 339–359.

Cincera, J. (2019). *Pro-environmental behavior in environmental education program*. Rwlnetwork. https://www.rwlnetwork.org/media/67161/proenvironmental_behavior_models.pdf.

Cobbinah, P. B., Poku-Boansi, M., & Peprah, C. (2017). Urban environmental problems in Ghana. *Environ. Dev.*, *23*, 33–46. https://doi.org/10.1016/j.envdev.2017.05.001.

Cottrell, S. P. (2003). Influence of sociodemographics and environmental attitudes on general responsible environmental behavior among recreational boaters. *Environ. Behav.*, *35*(3), 347–375. https://doi.org/10.1177/0013916503035003003.

D'Amato, L. & Krasny, M. (2011). Outdoor adventure education: Applying transformative learning theory to understanding instrumental learning and personal growth in environmental. *J. Environ. Educ.*, *42*(4), 237–254. https://doi.org/10.1080/00958964.2011.581313.

Deacon, R. & Shapiro, P. (1975). Private preference for collective goods revealed through voting on referenda. *Am. Econ. Rev.*, *65*(5), 943–955.

Edwards, B. & Lomax, N. (2012). 'For a richer New Zealand': Environmentalism and the Green Party in the 2011 New Zealand general election. *Environ. Polit.*, *21*(6), 994–1000. https://doi.org/10.1080/09644016.2012.724219.

Feinstein, B. C. (2004). Learning and transformation in the context of Hawaiian traditional ecological knowledge. *Adult Educ. Q.*, *54*(2), 105–120. https://doi.org/10.1177/0741713603260275.

Fornell, C. & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *J. Mark. Res.*, *18*(1), 39–50. https://doi.org/10.2307/3151312.

Gauja, A. & Jackson, S. (2016). Australian Greens party members and supporters: Their profiles and activities. *Environ. Polit.*, *25*(2), 359-379. https://doi.org/10.1080/09644016.2015.1104803.

Giddens, A. (2012). Modernity and Self Identity, Chapter 5. In *CSUSM University*. https://biblio.csusm.edu/sites/default/files/reserves/giddens_modernity_and_self-identity_ocr.pdf.

Gill, J. D., Crosby, L. A., & Taylor, J. R. (1986). Ecological concern, attitudes, and social norms in voting behavior. *Public Opin. Q.*, *50*(4), 537–554. https://doi.org/10.1086/269002.

Gul, İ., Gedik, O., Canbaz, M., & Saraclı, S. (2023). Hizmetkar liderlik ve yenilikçi davranış arasındaki ilişkide calışan sadakatinin aracı rolünün PLS-SEM ile incelenmesi. *Nicel Bilim. Derg.*, *5*(2), 29–50. https://doi.org/10.51541/nicel.1139405.

Hair, J., Anderson, R., Tatham, R., & Black, W. (1998). *Multivariate Data Analysis*. 5th Edition, Prentice Hall, New Jersey. https://www.scirp.org/(S(351jmbntvnsjt1aadkozje))/reference/referencespapers.aspx?referenceid=1051631.

Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2017). *A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM) Second Edition*. Los Angeles: Sage.

Hair, J. F., Ringle, C. M., & Sarstedt, M. (2011a). PLS-SEM: Indeed a silver bullet. *J. Mark. Theory Pract.*, *19*(2), 139–152. https://doi.org/10.2753/MTP1069-6679190202.

Hair, J. F., Sarstedt, M., Pieper, T. M., & Ringle, C. M. (2012). The use of partial least squares structural equation modeling in strategic management research: A review of past practices and recommendations for future applications. *Long Range Plan.*, *45*(5–6), 320–340. https://doi.org/10.1016/j.lrp.2012.09.008.

Hair, J. F., Sarstedt, M., Ringle, C. M., & Mena, J. A. (2011b). An assessment of the use of partial least squares structural equation modeling in marketing research. *J. Acad. Mark. Sci.*, *40*, 414–433. https://doi.org/10.1007/s11747-011-0261-6.

Heimlich, J. E. & Ardoin, N. M. (2008). Understanding behavior to understand behavior change: A literature review. *Environ. Educ. Res.*, *14*(3), 215–237. https://doi.org/10.1080/13504620802148881.

Henseler, J., Dijkstra, T. K., Sarstedt, M., Ringle, C. M., Diamantopoulos, A., Straub, D. W., Ketchen, D. J., Hair, J. F., Hult, G. T. M., & Calantone, R. J. (2014). Common beliefs and reality about PLS: Comments on rönkkö and Evermann (2013). *Organ. Res. Methods.*, *17*(2), 182–209. https://doi.org/10.1177/1094428114526928.

Henseler, J., Hubona, G., & Ray, P. A. (2016). Using PLS path modeling in new technology research: Updated guidelines. *Ind. Manag. Data Syst.*, *116*(1), 2–20. https://doi.org/10.1108/IMDS-09-2015-0382

Hines, J. M., Hungerford, H. R., & Tomera, A. N. (1987). Analysis and synthesis of research on responsible environmental behavior: A meta-analysis. *J. Environ. Educ.*, *18*, 1–8. https://doi.org/10.1080/00958964.1987.9943482.

Holbert, R. L., Kwak, N., & Shah, D. V. (2003). Environmental concern, patterns of television viewing, and pro-environmental behaviors: Integrating models of media consumption and effects. *J. Broadcast. Electron. Media.*, *47*(2), 177–196. https://doi.org/10.1207/s15506878jobem4702_2.

Höök, K. & Löwgren, J. (2012). Strong concepts: Intermediate-level knowledge in interaction design research. *ACM Trans. Comput. Hum. Interact. (TOCHI)*, *19*(3), 1–18. https://doi.org/10.1145/2362364.2362371.

Hungerford, H. R. & Volk, T. L. (1990). Changing learner behavior through environmental education. *J. Environ. Educ.*, *21*, 8–21. https://doi.org/10.1080/00958964.1990.10753743.

Kahn, M. E. (2002). Demographic change and the demand for environmental regulation. *J. Policy Anal. Manag.*, *21*(1), 45–62. https://doi.org/10.1002/pam.1039.

Kahn, M. E. & Matsusaka, J. G. (1997). Demand for environmental goods: Evidence from voting patterns on California initiatives. *J. Law Econ.*, *40*(1), 137-174.

Kılıç, Ç. & Kan, A. (2020). Çevre sorunlarına yönelik tutum ölçeği geliştirme çalışması. *Abant Izzet Baysal Univ. Educ. Fac. J.*, *20*(4), 1676–1690. https://doi.org/10.17240/aibuefd.2020.20.58249-540945.

Korah, P. I. & Cobbinah, P. B. (2016). Juggling through Ghanaian urbanisation: Flood hazard mapping of Kumasi. *Geo J.*, *82*, 1195–1212. https://doi.org/10.1007/s10708-016-9746-7.

Levine, D. S. & Strube, M. J. (2012). Environmental attitudes, knowledge, intentions and behaviors among college students. *J. Soc. Psychol.*, *152*(3), 308–326. https://doi.org/10.1080/00224545.2011.604363.

Marcoulides, G. A. & Saunders, C. (2006). Editor's comments: PLS: A silver bullet? *MIS Quarterly*, *30*(2), 3–9. https://doi.org/10.2307/25148727.

McDonald, R. P. (1996). Path analysis with composite variables. *Multivar. Behav. Res.*, *31*(2), 239–270. https://doi.org/10.1207/s15327906mbr3102_5.

Mezirow, J. (1994). Understanding transformation theory. *Adult Educ. Q.*, *44*(4), 222–244. https://doi.org/10.1177/0741713694044004.

Milton, B., Cleveland, E., & Bennett-Gates, D. (1995). Changing perceptions of nature, self, and others: A report on a park/school program. *J. Environ. Educ.*, *26*(3), 32–39. https://doi.org/10.1080/00958964.1995.9941443.

Mpofu, T. P. (2013). Environmental challenges of urbanization: A case study for open green space management. *Res. J. Agric. Environ. Manag.*, *2*(4), 105–110.

News Waste Recycling European Environment Agency. (2023). *Plastic waste and recycling in the EU: Facts and figures*. News European Parliament. https://www.europarl.europa.eu/news/en/headlines/society/20181212STO21610/plastic-waste-and-recycling-in-the-eu-facts-and-figures.

Papp, Z. (2022). Environmental attitudes, environmental problems and party choice, A large-N comparative study. *Polit. Geogr.*, *97*, 102652. https://doi.org/10.1016/j.polgeo.2022.102652.

Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: a critical review of the literature and recommended remedies. *J. Appl. Psychol.*, *88*(5), 879. https://doi.org/110.1037/0021-9010.88.5.879.

Quagraine, V. K. (2011). Urban landscape depletion in the Kumasi Metropolis. *Fut. Tree. Grow. Dev. Kum.*, 212–233.

Ramsey, C. E. & Rickson, R. E. (1976). Environmental knowledge and attitudes. *J. Environ. Educ.*, *8*, 10–18. https://doi.org/10.1080/00958964.1976.9941552.

Reisinger, Y. & Turner, L. (1999). Structural equation modeling with Lisrel: Application in tourism. *Tour. Manag.*, *20*(1), 71–88. https://doi.org/10.1016/S0261-5177(98)00104-6.

Rüdig, W. (2012). The perennial success of the German Greens. *Environ. Polit.*, *21*(1), 108-130. https://doi.org/10.1080/09644016.2011.643371.

Rudman, L. A., McLean, M. C., & Bunzl, M. (2013). When truth is personally inconvenient, attitudes change: The impact of extreme weather on implicit support for green politicians and explicit climate-change beliefs. *Psychol. Sci.*, *24*(11), 2290–2296. https://doi.org/10.1177/0956797613492775.

Sakçı, G. & Uyanık, G. (2023). Sınıf öğretmenlerinin çevre sorunlarına ilişkin tutumlarının ve çevresel duyarlılıklarının incelenmesi. *Int. J. Eurasia Soc. Sci. (IJOESS)*, *14*(53), 1170–1193. https://doi.org/10.35826/ijoess.3324.

Saraçlı, S. & Boca, G. D. (2021). Factors influencing students environmental education for sustainable development in Romania and Turkey. *Environ. Eng. Manag. J.*, *20*(1), 1–12.

Saraçlı, S. & Ulucan, O. (2021). Examination of effects of radiation awareness on protection from radiation via structural equation modeling. *Cumhuriyet Sci. J.*, *42*(2), 434–440. https://doi.org/10.17776/csj.857930.

Saraçlı, S., Yılmaz, V., & Arslan, T. (2014). The effects of mothers' educational levels on university students' environmental protection commitments and environmental behaviors. *Eurasian J. Educ. Res.*, *55*, 177–200. https://doi.org/10.14689/ejer.2014.55.11.

Sciarini, P., Bornstein, N., & Lanz, B. (2007). *The Determinants of Voting Choices on Environmental Issues: A Two-Level Analysis*. In The dynamics of referendum campaigns: An international perspective. London: Palgrave Macmillan UK. https://doi.org/10.1057/9780230591189_11.

Scott, D. & Willits, F. K. (1994). Environmental attitudes and behavior: A Pennsylvania survey. *Environ. Behav.*, *26*(2), 239–260. https://doi.org/10.1177/001391659402600206.

Stern, P. C. (2000). Toward a coherent theory of environmentally significant behavior. *J. Soc. Issues.*, *56*, 407–424. https://doi.org/10.1111/0022-4537.00175.

Uyanık, G. (2016). Öğretmen adaylarının çevre sorunlarına ilişkin bilgi düzeylerinin ve tutumlarının incelenmesi. *Online Fen Egitim Derg.*, *1*(1), 30–41.

Vaske, J. J. & Donnelly, M. P. (1999). A value-attitude-behavior model predicting wildland preservation voting intentions. *Soc. Nat. Resour.*, *12*(6), 523–537. https://doi.org/10.1080/089419299279425

WHO. (2013). *Global Health Observatory data repository*. Household Air Pollution. http://apps.who.int/gho/data/node.main.125?lang=en.

Williamson, D. & Lynch-Wood, G. (2001). A new paradigm for SME environmental practice. *TQM Mag.*, *13*(6), 424–433. https://doi.org/10.1108/EUM0000000006179.

Wynveen, C., Kyle, G. T., & Tarrant, M. A. (2011). Study abroad experiences and global citizenship fostering proenvironmental behavior. *J. Stud. Int. Educ.*, *16*(4), 334–352. https://doi.org/10.1177/1028315311426782.