Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

Sustainable behavioural intention and its influencing factors among vocational college students in an artificial oasis: A cross-sectional survey exploring the mediating roles of self-efficacy, environmental participation and local ecological concern

Yuhua Jin

003227@zjjs.edu.cn

Zhejiang College of Construction

Article

Keywords: Sustainable behavioural intention, pro-environmental behaviour, environmental education, artificial oasis, mediation analysis, vocational college students

Posted Date: November 19th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-11508030/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License.
Read Full License

Additional Declarations: No competing interests reported.

Abstract

Fostering sustainable behaviour among young people in water-scarce regions is essential for arid-land sustainability, yet the mechanisms linking environmental knowledge to behavioural intention remain underspecified, particularly among vocational college students. This cross-sectional study examined how self-efficacy, environmental participation and local ecological concern mediate the relationship between environmental knowledge and sustainable behavioural intention among 659 students at Tarim Vocational and Technical College in the artificial oasis of Aral, Xinjiang, China. Participants completed a 24-item questionnaire. Parallel mediation analysis (PROCESS Model 4, 5,000 bootstrap samples) revealed that environmental knowledge exerted a significant total effect on sustainable behavioural intention (B = 0.378, 95% CI [0.324, 0.432]). The indirect effects via local ecological concern (B = 0.219), self-efficacy (B = 0.098) and environmental participation (B = 0.046) were all significant, while the direct effect was non-significant, indicating full mediation. Confirmatory factor analysis supported the five-factor structure, and robustness checks omitting local ecological concern confirmed the mediation of self-efficacy and participation. These findings underscore the pivotal role of local ecological attachment in translating environmental knowledge into sustainable intentions in arid artificial-oasis contexts, with implications for environmental education and green-campus policy.

Introduction

Sustainable development demands not only technological and policy change but also the cultivation of pro-environmental attitudes and behaviours among citizens, and young people in higher education are a particularly strategic group because they will shape future consumption, governance and innovation patterns[1–3]. Within higher education, vocational college students constitute a large but comparatively understudied population[4]. In China, vocational (higher technical) colleges enrol millions of students annually, many of whom enter blue- and grey-collar occupations where everyday resource use—water, energy and materials—has direct environmental consequences. Understanding what drives their sustainable behavioural intention is therefore of both scholarly and practical value.

A central and recurring finding in environmental psychology is the gap between environmental knowledge and pro-environmental behaviour[5–7]. People may hold substantial factual knowledge about climate change, resource scarcity or pollution and yet fail to translate that knowledge into action. The Knowledge-Attitude-Practice (KAP) model and its extensions propose that knowledge shapes attitudes, which in turn shape behaviour[8–10], while the Theory of Planned Behaviour (TPB) and the Value–Belief–Norm (VBN) theory emphasise attitudes, perceived behavioural control, norms and values as proximal drivers[11–13]. Meta-analytic evidence confirms that psychosocial factors such as self-efficacy, norms and attitudes are among the strongest correlates of pro-environmental behaviour[6, 14]. However, the specific pathways through which knowledge becomes intention—and the conditions under which these pathways operate—remain insufficiently understood, especially in under-researched populations and settings.

One promising candidate pathway is self-efficacy, the belief in one's ability to perform an action, which Bandura identified as a central determinant of behavioural engagement[15]. In the environmental domain, perceived self-efficacy consistently predicts pro-environmental intention and behaviour[16–18]. Another pathway is environmental participation—active engagement in lectures, courses, campaigns and volunteer activities—which may convert abstract knowledge into embodied commitment and practical skills[19, 20]. Finally, local ecological concern, understood here as attachment to and concern for the specific water-scarce oasis landscape in which respondents live, may act as an emotional bridge between general environmental knowledge and personal behavioural commitment[21–23]. Place attachment has been shown to promote pro-environmental behaviour[24–26], and in arid regions where water is the defining resource, local ecological concern may be an especially potent motivator[27–29].

The Tarim Basin in Xinjiang, northwestern China, is one of the most arid regions on Earth, with the Tarim River supporting a chain of artificial oases on which several million people depend for agriculture, industry and urban life[27–30]. Water scarcity in this region is acute, precipitation is minimal and ecological fragility is high. Students enrolled in vocational colleges within such artificial-oasis cities live daily amid these constraints, making their sustainable behavioural intentions directly relevant to regional water conservation and ecological resilience.

Despite the theoretical and practical importance of this population, no study, to our knowledge, has simultaneously examined self-efficacy, environmental participation and local ecological concern as parallel mediators of the knowledge–intention relationship among vocational college students in an artificial-oasis setting. The present study addresses this gap. We hypothesised that (H1) environmental knowledge would positively predict sustainable behavioural intention; (H2) self-efficacy would mediate this relationship; (H3) environmental participation would mediate this relationship; and (H4) local ecological concern would mediate this relationship. In addition, we examined sociodemographic differences in sustainable behavioural intention and the incremental explanatory power of the psychological mediators over demographic characteristics.

Results

Sample characteristics and descriptive statistics

After excluding 56 responses that selected an identical option across all 24 scale items and were completed in under 60 s, the final sample comprised 659 vocational college students (351 males, 53.26%; 308 females, 46.74%). A total of 48.10% were from the "other" major category, 44.01% were management majors, 7.28% were engineering majors and 0.61% were agriculture/forestry majors. Most students (48.25%) came from rural areas; 73.14% had studied an environment-related course before admission, and 70.41% originated from provinces other than Xinjiang. Table 1 summarises the sample. Descriptive statistics for the five dimensions are presented in Table 2. Mean scores were high overall, with sustainable behavioural intention (4.34 ± 0.67) and local ecological concern (4.36 ± 0.69) being the

highest and environmental participation the lowest (3.76 ± 0.90). Figure 1 presents the mean scores of the five dimensions.

Table 1
Sociodemographic characteristics of the sample (N = 659).

Variable	Category	n	Percentage (%)
Gender	Male	351	53.26
	Female	308	46.74
Major category	Other	317	48.10
	Management	290	44.01
	Engineering	48	7.28
	Agriculture/Forestry	4	0.61
Family residence	Rural	318	48.25
	City	121	18.36
	Township	120	18.21
	County town	100	15.17
Visited Xinjiang before admission	No	418	63.43
	Yes	241	36.57
Environment course before admission	Yes	482	73.14
	No	177	26.86
Place of origin	Other provinces	464	70.41
	Xinjiang	195	29.59

Table 2
Descriptive statistics of the five dimensions (N = 659).

Dimension	Items	Mean	SD	Skewness	Kurtosis
Environmental knowledge	6	4.20	0.84	-1.50	2.98
Self-efficacy	5	4.30	0.75	-1.24	2.39
Environmental participation	5	3.76	0.90	-0.13	-0.75
Sustainable behavioural intention	6	4.34	0.67	-0.93	1.34
Local ecological concern	2	4.36	0.69	-0.83	0.52

Reliability and validity

All five dimensions demonstrated high internal consistency, with Cronbach's alpha coefficients of 0.940 (environmental knowledge), 0.942 (self-efficacy), 0.937 (environmental participation), 0.955 (sustainable behavioural intention) and 0.914 (local ecological concern); the alpha for the total 24-item scale was 0.963. Corrected item–total correlations ranged from 0.711 to 0.896, and deletion of any single item did not substantially improve the alpha of its dimension, indicating satisfactory reliability (Supplementary Table S1).

The Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy was 0.962 and Bartlett's test of sphericity was significant ($\chi^2(276) = 17{,}034.932$, $p < 0.001$), supporting the factorability of the data. Exploratory factor analysis with principal component extraction and Varimax rotation extracted four factors with eigenvalues greater than 1, accounting for 80.18% of the total variance. The rotated loadings indicated that sustainable behavioural intention and local ecological concern items loaded predominantly on the first factor (loadings 0.759–0.808), environmental knowledge items on the second factor, environmental participation items on the third factor and self-efficacy items on the fourth factor (Supplementary Table S2). Harman's single-factor test showed that the first unrotated factor explained 56.77% of the variance (eigenvalue 13.625), which is below the conventional 60% threshold but merits cautious interpretation of potential common-method bias.

Confirmatory factor analysis (MLR estimation) compared three competing models (Table 3). The five-factor model provided the best fit ($\chi^2/df = 3.973$, CFI = 0.958, TLI = 0.952, RMSEA = 0.067, SRMR = 0.033), outperforming a four-factor model in which sustainable behavioural intention and local ecological concern were merged, and a single-factor model. Standardised factor loadings ranged from 0.720 to 0.935 (all $p < 0.001$), and average variance extracted (AVE) and composite reliability (CR) values were 0.733–0.842 and 0.914–0.956, respectively (Supplementary Table S3). However, the AVE square root of sustainable behavioural intention (0.885) and local ecological concern (0.918) were smaller than their inter-factor correlation (0.921), indicating that discriminant validity between these two dimensions was not fully established.

Table 3
Fit indices of the three competing CFA models (N = 659, MLR estimation).

Model	χ^2/df	CFI	TLI	RMSEA	SRMR
Five-factor (theoretical)	3.973	0.958	0.952	0.067	0.033
Four-factor (intention + concern merged)	4.419	0.951	0.945	0.072	0.033
Single-factor	25.026	0.644	0.610	0.191	0.124

Correlations among dimensions

Pearson correlations among the five dimensions were all positive and significant (all $p < 0.001$), ranging from $r = 0.388$ (environmental knowledge and environmental participation) to $r = 0.863$ (sustainable behavioural intention and local ecological concern) (Table 4, Fig. 2). Sustainable behavioural intention correlated at $r = 0.525$ with environmental knowledge, $r = 0.731$ with self-efficacy, $r = 0.671$ with environmental participation and $r = 0.863$ with local ecological concern.

Table 4
Means, standard deviations and Pearson correlations among dimensions (N = 659).

Variable	M	SD	1	2	3	4	5
1. Environmental knowledge	4.20	0.84	1				
2. Self-efficacy	4.30	0.75	0.661***	1			
3. Environmental participation	3.76	0.90	0.388***	0.582***	1		
4. Sustainable behavioural intention	4.34	0.67	0.525***	0.731***	0.671***	1	
5. Local ecological concern	4.36	0.69	0.505***	0.690***	0.618***	0.863***	1

Parallel mediation analysis

PROCESS Model 4 with 5,000 bootstrap samples was used to test the parallel mediation model in which environmental knowledge served as the independent variable, self-efficacy, environmental participation and local ecological concern served as parallel mediators, and sustainable behavioural intention served as the dependent variable, controlling for gender, major category, family residence, prior visit to Xinjiang, prior environment course and place of origin. As shown in Table 5 and Fig. 3, environmental knowledge had a significant total effect on sustainable behavioural intention ($B = 0.378$, $SE = 0.027$, 95% CI [0.324, 0.432]). Environmental knowledge significantly predicted self-efficacy ($B = 0.576$), environmental participation ($B = 0.371$) and local ecological concern ($B = 0.370$), all $p < 0.001$. In the model including all three mediators, self-efficacy ($B = 0.170$), environmental participation ($B = 0.124$) and local ecological concern ($B = 0.590$) each significantly predicted sustainable behavioural intention (all $p < 0.001$), whereas the direct effect of environmental knowledge was non-significant ($B = 0.015$, $SE = 0.019$, $p = 0.427$, 95% CI [-0.023, 0.053]). The total indirect effect was 0.363 (95% CI [0.280, 0.456]). All three specific indirect effects were significant: via local ecological concern ($B = 0.219$, 95% CI [0.162, 0.285]), via self-efficacy ($B = 0.098$, 95% CI [0.056, 0.150]) and via environmental participation ($B = 0.046$, 95% CI [0.028, 0.067]). These results indicate full mediation, with local ecological concern being the strongest pathway.

Table 5
Total, direct and indirect effects of the parallel mediation model (Bootstrap 5,000).

Effect	B	Boot SE	95% CI lower	95% CI upper	Significant
Total effect	0.3778	0.0274	0.3240	0.4315	Yes
Direct effect	0.0153	0.0192	-0.0225	0.0531	No
Total indirect effect	0.3625	0.0451	0.2803	0.4557	Yes
Knowledge → Self-efficacy → Intention	0.0980	0.0238	0.0562	0.1500	Yes
Knowledge → Participation → Intention	0.0459	0.0101	0.0277	0.0671	Yes
Knowledge → Local concern → Intention	0.2186	0.0315	0.1617	0.2845	Yes

Group differences in sustainable behavioural intention

Independent-sample t-tests revealed that female students reported higher sustainable behavioural intention (4.46 ± 0.59) than male students (4.23 ± 0.71), $t(657) = 4.445$, $p < 0.001$. Students who had studied an environment-related course before admission reported higher intention (4.44 ± 0.60) than those who had not (4.06 ± 0.76), $t(657) = -6.634$, $p < 0.001$. No significant differences emerged for prior visit to Xinjiang ($p = 0.299$) or place of origin ($p = 0.380$). One-way ANOVA revealed a significant effect of major category, $F(3, 655) = 6.366$, $p < 0.001$; LSD post-hoc comparisons showed that management majors (4.43 ± 0.62) scored higher than "other" majors (4.29 ± 0.67, $p = 0.007$) and engineering majors (4.16 ± 0.79, $p = 0.008$), while the small agriculture/forestry subgroup ($n = 4$) scored lowest (3.42 ± 0.92). Differences by family residence were not significant, $F(3, 655) = 1.459$, $p = 0.225$. Figures 4 and 5 illustrate these group differences.

Hierarchical multiple regression

Hierarchical regression examined the incremental contribution of the psychological mediators over sociodemographic variables (Table 6). Model 1, containing only the control variables, was significant ($R^2 = 0.125$, adjusted $R^2 = 0.111$, $F(10, 648) = 9.243$, $p < 0.001$), with gender (male, $\beta = -0.155$, $p < 0.001$), prior environment course ($\beta = 0.255$, $p < 0.001$) and certain major categories as significant predictors. Adding the four psychological dimensions in Model 2 raised R^2 to 0.802 (adjusted $R^2 = 0.798$), $\Delta R^2 = 0.678$, $\Delta F(4, 644) = 551.899$, $p < 0.001$. In Model 2, local ecological concern ($\beta = 0.606$, $t = 22.841$), self-efficacy ($\beta = 0.190$, $t = 6.536$) and environmental participation ($\beta = 0.166$, $t = 7.146$) were all significant predictors (all $p < 0.001$), whereas environmental knowledge was not ($\beta = 0.019$, $p = 0.427$). All variance inflation factors were below 2.8, and Durbin-Watson statistics were approximately 2, indicating no serious multicollinearity or autocorrelation.

Table 6
Hierarchical regression predicting sustainable behavioural intention (N = 659).

Variable	Model 1 β	p	Model 2 β	p	VIF (M2)
Gender (male)	-0.155	< 0.001	-0.032	0.093	1.180
Major: Agriculture/Forestry	-0.098	0.009	-0.025	0.169	1.046
Major: Engineering	-0.031	0.422	-0.040	0.029	1.090
Major: Management	0.078	0.043	-0.001	0.942	1.104
Prior environment course (yes)	0.255	< 0.001	0.029	0.132	1.171
Environmental knowledge	—	—	0.019	0.427	1.879
Self-efficacy	—	—	0.190	< 0.001	2.757
Environmental participation	—	—	0.166	< 0.001	1.767
Local ecological concern	—	—	0.606	< 0.001	2.294
Model fit	R^2 = 0.125		R^2 = 0.802		
	ΔR^2 = 0.678		DW = 1.983		

Robustness check

Because sustainable behavioural intention and local ecological concern were highly correlated (r = 0.863), we re-ran the mediation model excluding local ecological concern and retaining only self-efficacy and environmental participation as parallel mediators. The total effect remained significant (B = 0.378), the direct effect remained non-significant (B = 0.043, SE = 0.026, 95% CI [-0.008, 0.094]), and the total indirect effect was 0.335 (95% CI [0.262, 0.414]). The indirect effects via self-efficacy (B = 0.237, 95% CI [0.176, 0.307]) and via environmental participation (B = 0.098, 95% CI [0.065, 0.133]) were both significant. The full model R^2 was 0.642, lower than the 0.802 obtained when local ecological concern was included, confirming the substantial explanatory contribution of local ecological concern.

Discussion

This study examined the mechanisms linking environmental knowledge to sustainable behavioural intention among vocational college students in an artificial-oasis setting. Consistent with H1, environmental knowledge exerted a significant total effect on sustainable behavioural intention, echoing the broader evidence that knowledge and awareness underpin pro-environmental commitment[5, 8, 31]. Critically, the direct effect of knowledge became non-significant once the three mediators were introduced, indicating full mediation and supporting H2–H4. The finding that self-efficacy, environmental participation and, above all, local ecological concern carried the knowledge–intention relationship

highlights that knowledge per se is not a sufficient condition for sustainable intention; it must be mobilised through confidence, experiential engagement and place-based emotional connection.

The prominence of local ecological concern as the strongest mediator is a distinctive contribution of this study. In the water-scarce artificial-oasis context of the Tarim Basin, where irrigation, urban water supply and ecological flows compete for the same limited resource, students' attachment to and concern for their local oasis and its water resources appear to translate general environmental knowledge into personally relevant commitment. This resonates with research showing that place attachment and natural bonding promote pro-environmental behaviour[21, 23–25] and with watershed-level evidence that belonging and ecological concern motivate protective action[27–29]. Our findings suggest that environmental education in arid regions may be most effective when it is place-based—anchored in students' lived experience of local water scarcity and oasis ecology—rather than purely abstract.

Self-efficacy also emerged as a significant mediator, consistent with social-cognitive accounts[15] and with evidence that perceived behavioural control and self-efficacy predict environmental intention[16–18]. Students who believe they can conserve water, sort waste and reduce disposable-plastic use are more likely to intend to do so. Environmental participation—exposure to lectures, campaigns, volunteer activities and peer discussion—likewise mediated the knowledge–intention link, consistent with the view that experiential and social learning converts knowledge into commitment[19, 20]. Notably, students who had studied an environment course before admission scored higher across all dimensions (Fig. 4), reinforcing the value of formal environmental education.

Our findings extend the broader evidence that structured environmental education translates knowledge into pro-environmental intention. Consistent with recent studies showing that environmental knowledge promotes sustainable-living intentions among higher-education students[33] and that ecological-civilisation education embedded in ideological and political curricula strengthens college students' willingness to act pro-environmentally[34], our results indicate that experiential and participatory learning environments, rather than abstract knowledge transfer alone, are decisive in converting knowledge into behavioural commitment. The mediating role of self-efficacy likewise resonates with intervention evidence that developing efficacy beliefs through coaching and peer-led initiatives fosters sustainability engagement[36], and with findings that green self-efficacy, together with subjective norms, mediates the relationship between environmental attitudes and behaviour among Chinese undergraduates[37]. From an educational-practice standpoint, these results imply that curricula combining place-based content with mastery experiences and structured participation, such as hands-on water-saving, waste-sorting and volunteer schemes, are likely to be more effective than purely knowledge-focused programmes, and that such participatory designs should be embedded across disciplines rather than confined to dedicated environment courses.

At a theoretical level, the full mediation we observed is consistent with an extended value-belief-norm perspective in which values, beliefs and personal norms shape behaviour through intervening psychological states, and with evidence that place attachment mediates the link between pro-

environmental attitudes and behaviour[35]. In the artificial-oasis setting, local ecological concern may be an especially potent mediator because the region's water constraints are both salient and personally consequential: recent hydrological analyses indicate that water availability across China's oases declined between 1987 and 2017 [38], while ecological water allocation and conveyance in the Tarim basin are pivotal to sustaining oasis ecosystems and riparian vegetation[27, 39]. Enhancing students' concern for their local oasis, and the water resources on which it depends, therefore offers a targeted, policy-relevant route to promoting sustainable behaviour in arid vocational-college settings, complementing broader green-campus and water-conservation policies.

Several demographic patterns warrant comment. Female students reported higher sustainable behavioural intention than males, consistent with prior studies[32], and management majors showed higher intention than engineering or agriculture/forestry majors. Prior visit to Xinjiang and place of origin were not associated with intention, suggesting that living in the oasis region itself, rather than whether students originally came from Xinjiang, shapes sustainable intention—an interpretation consistent with the mediating role of local ecological concern.

These findings carry practical implications. First, environmental education in arid vocational colleges should integrate place-based modules on local water resources and oasis ecology to cultivate local ecological concern. Second, curricula and campus campaigns should strengthen self-efficacy through mastery experiences (e.g., hands-on water-saving and waste-sorting practices). Third, structured environmental participation—volunteer programmes, eco-clubs and green-campus initiatives—should be expanded, as they convert knowledge into behavioural commitment.

This study has limitations. The cross-sectional design precludes causal inference, although the proposed model was theory-driven. Data were self-reported, and the relatively high Harman single-factor variance (56.77%) indicates that common-method bias cannot be entirely ruled out, even though the CFA supported a five-factor structure. Discriminant validity between sustainable behavioural intention and local ecological concern was not fully established, a finding that should be explored in future work. The sample was drawn from a single institution in one oasis city, limiting generalisability, and the agriculture/forestry subgroup was very small (n = 4). Finally, behavioural intention rather than actual behaviour was measured; future longitudinal or intervention studies should examine whether these intentions translate into sustained pro-environmental action.

In conclusion, among vocational college students in an artificial-oasis region, the effect of environmental knowledge on sustainable behavioural intention operates fully through self-efficacy, environmental participation and, most strongly, local ecological concern. Fostering place-based ecological concern, alongside confidence-building and experiential participation, offers a promising route to promoting sustainable behaviour in arid China.

Methods

Study design and participants

A cross-sectional survey was conducted in 2026 at Tarim Vocational and Technical College, located in Aral City, an artificial-oasis city in the Tarim Basin, Xinjiang, China. Participants were recruited voluntarily through class-based administration. A total of 715 questionnaires were returned; after excluding 56 responses that selected an identical option across all 24 scale items and were completed in under 60 seconds, the final analytic sample comprised 659 students. All procedures were performed in accordance with relevant guidelines and regulations. This study was reviewed and approved by the research ethics committee of the authors' institution, and informed consent was obtained from all participants. Data were collected anonymously and no personally identifiable information was retained.

Measures

The questionnaire comprised 24 items measuring five dimensions, each rated on a 5-point scale. Environmental knowledge (6 items) assessed understanding of greenhouse-gas emissions, water conservation, waste sorting, disposable plastics, standby energy and green transport (1 = "do not understand at all" to 5 = "understand very well"). Self-efficacy (5 items) assessed perceived ease of performing water-saving, waste-sorting, energy-saving, plastic-reduction and green-transport behaviours. Environmental participation (5 items) assessed attendance at environmental lectures, volunteer activities, exposure in coursework, attention to campus information and peer discussion. Sustainable behavioural intention (6 items, the dependent variable) assessed willingness to conserve water, learn about the environment, reduce plastics, switch off appliances, join volunteer activities and sort waste. Local ecological concern (2 items) assessed concern about local water scarcity and protection of the Tarim oasis ecosystem. Dimension scores were computed as the mean of the constituent items. Sociodemographic variables included gender, major category, family residence, prior visit to Xinjiang, prior environment course and place of origin (dichotomised as Xinjiang vs. other provinces).

Data analysis

Analyses were conducted in Python 3.12 (pandas, numpy, scipy, statsmodels, pingouin, factor_analyzer) and R 4.5.3 (lavaan for confirmatory factor analysis; car for variance inflation factors). Mediation analysis was conducted using Hayes' official PROCESS macro for R (Model 4) with 5,000 bootstrap samples and 95% percentile confidence intervals. Reliability was assessed with Cronbach's alpha, corrected item–total correlations and alpha-if-item-deleted. Construct validity was examined through exploratory factor analysis (principal component extraction, Varimax rotation, eigenvalues > 1) and confirmatory factor analysis with MLR estimation, comparing five-factor, four-factor and single-factor models using χ^2/df, CFI, TLI, RMSEA and SRMR. Harman's single-factor test assessed common-method bias. Group differences were tested with independent-sample t-tests and one-way ANOVA with LSD post-hoc comparisons. Hierarchical multiple regression examined incremental explanatory power. An alpha level of 0.05 (two-tailed) was used for all tests, and exact p-values are reported throughout.

Declarations

Acknowledgements

The author thanks the students of Tarim Vocational and Technical College who participated in this survey, and the faculty who assisted with questionnaire administration.

Author contributions

Y.J. designed the study, conducted the survey, performed the statistical analyses, interpreted the data, and wrote and revised the manuscript.

Funding

No funding was received for this manuscript.

Data availability

The datasets analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

The author declares no competing interests.

Additional information

Publisher's note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

References

1. Stern, P. C. New environmental theories: Toward a coherent theory of environmentally significant behavior. *J. Soc. Issues*. **56**, 407–424. https://doi.org/10.1111/0022-4537.00188 (2000).
2. Steg, L. & Vlek, C. Encouraging pro-environmental behaviour: An integrative review and research agenda. *J. Environ. Psychol.* **29**, 309–317. https://doi.org/10.1016/j.jenvp.2008.10.004 (2009).
3. Hines, J. M., Hungerford, H. R. & Tomera, A. N. 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 (1987).
4. Li, Z. & Zhang, R. Pro-environmental behaviors and environmental value orientation of vocational college students in China. *Sustainability* **16**, 9694. https://doi.org/10.3390/su16229694 (2024).
5. Kollmuss, A. & Agyeman, J. Mind the gap: Why do people act environmentally and what are the barriers to pro-environmental behavior? Environ. *Educ. Res.* **8**, 239–260. https://doi.org/10.1080/13504620220145401 (2002).

6. Bamberg, S. & Möser, G. Twenty years after Hines, Hungerford, and Tomera: A new meta-analysis of psycho-social determinants of pro-environmental behaviour. *J. Environ. Psychol.* **27**, 14–25. https://doi.org/10.1016/j.jenvp.2006.12.002 (2007).
7. Whitmarsh, L. & O'Neill, S. Green identity, green living? The role of pro-environmental self-identity in determining consistency across diverse pro-environmental behaviours. *J. Environ. Psychol.* **30**, 305–314. https://doi.org/10.1016/j.jenvp.2010.02.004 (2010).
8. Wang, K. & Zhang, L. The impact of ecological civilization theory on university students' pro-environmental behavior: An application of knowledge-attitude-practice theoretical model. *Front. Psychol.* **12**, 681409. https://doi.org/10.3389/fpsyg.2021.681409 (2021).
9. Paço, A. & Lavrador, T. Environmental knowledge and attitudes and behaviours towards energy consumption. *J. Environ. Manage.* **197**, 384–392. https://doi.org/10.1016/j.jenvman.2017.03.100 (2017).
10. Ajzen, I. The theory of planned behavior. *Organ. Behav. Hum. Decis. Process.* **50**, 179–211. https://doi.org/10.1016/0749-5978(91)90020-T (1991).
11. Onel, N. Transforming consumption: The role of values, beliefs, and norms in promoting four types of sustainable behavior. *J. Consum. Behav.* **23**, 491–513. https://doi.org/10.1002/cb.2212 (2024).
12. Gifford, R. & Nilsson, A. Personal and social factors that influence pro-environmental concern and behaviour: A review. *Int. J. Psychol.* **49**, 141–157. https://doi.org/10.1002/ijop.12034 (2014).
13. Bamberg, S. & Schmidt, P. Incentives, morality, or habit? Predicting students' car use for university routes with the models of Ajzen, Schwartz, and Triandis. *Environ. Behav.* **35**, 264–285. https://doi.org/10.1177/0013916502250137 (2003).
14. Klöckner, C. A. A comprehensive model of the psychology of environmental behaviour—A meta-analysis. *Glob Environ. Change*. **23**, 1028–1038. https://doi.org/10.1016/j.gloenvcha.2013.06.005 (2013).
15. Bandura, A. Self-efficacy: Toward a unifying theory of behavioral change. *Psychol. Rev.* **84**, 191–215. https://doi.org/10.1037/0033-295X.84.2.191 (1977).
16. Tabernero, C. & Hernández, B. Self-efficacy and intrinsic motivation guiding environmental behavior. *Environ. Behav.* **43**, 658–675. https://doi.org/10.1177/0013916510379759 (2011).
17. Chen, M. F. Self-efficacy or collective efficacy within the cognitive theory of stress model: Which more effectively explains people's self-reported proenvironmental behavior? *J. Environ. Psychol.* **42**, 66–75. https://doi.org/10.1016/j.jenvp.2015.03.006 (2015).
18. Jugert, P. et al. Collective efficacy increases pro-environmental intentions through increasing self-efficacy. *J. Environ. Psychol.* **48**, 12–23. https://doi.org/10.1016/j.jenvp.2016.08.003 (2016).
19. Zelezny, L. C. Educational interventions that improve environmental behaviors: A meta-analysis. *J. Environ. Educ.* **31**, 5–14. https://doi.org/10.1080/00958969909598627 (1999).
20. Chen, C., Shahbaz, P. & Haq, S. u. Transforming students' green behavior through environmental education: The impact of institutional practices and policies. *Front. Psychol.* **15**, 1499781. https://doi.org/10.3389/fpsyg.2024.1499781 (2024).

21. Scannell, L. & Gifford, R. Defining place attachment: A tripartite organizing framework. *J. Environ. Psychol.* **30**, 1–10. https://doi.org/10.1016/j.jenvp.2009.09.006 (2010).
22. Scannell, L. & Gifford, R. The relations between natural and civic place attachment and pro-environmental behavior. *J. Environ. Psychol.* **30**, 289–297. https://doi.org/10.1016/j.jenvp.2009.09.009 (2010).
23. Ramkissoon, H., Smith, L. D. G. & Weiler, B. Testing the dimensionality of place attachment and its relationships with pro-environmental behaviours: A structural equation modelling approach. *Tour Manag*. **36**, 552–566. https://doi.org/10.1016/j.tourman.2012.09.001 (2013).
24. Gosling, E. & Williams, K. J. H. Connectedness to nature, place attachment and conservation behaviour: Testing connectedness theory among farmers. *J. Environ. Psychol.* **30**, 298–304. https://doi.org/10.1016/j.jenvp.2010.01.005 (2010).
25. Song, Z. & Soopramanien, D. Types of place attachment and pro-environmental behaviors of urban residents in Beijing. *Cities* **84**, 112–120. https://doi.org/10.1016/j.cities.2018.08.002 (2019).
26. Halpenny, E. A. Pro-environmental behaviours and park visitors: The effect of place attachment. *J. Environ. Psychol.* **30**, 409–421. https://doi.org/10.1016/j.jenvp.2010.05.001 (2010).
27. Jiao, A. et al. Effect evaluation of ecological water conveyance in Tarim River Basin, China. *Front. Environ. Sci.* **10**, 1019695. https://doi.org/10.3389/fenvs.2022.1019695 (2022).
28. Zhang, Z., Hu, H., Tian, F., Yao, X. & Sivapalan, M. Groundwater dynamics under water-saving irrigation and implications for sustainable water management in an oasis: Tarim River basin of western China. *Hydrol. Earth Syst. Sci.* **18**, 3951–3967. https://doi.org/10.5194/hess-18-3951-2014 (2014).
29. Hao, X., Chen, Y. & Li, W. The driving forces of environmental change during the last 50 years in the Tarim Basin. *Prog Phys. Geogr.* **33**, 84–103. https://doi.org/10.1177/0309133309105844 (2009).
30. Chen, D., Zeng, X., Gui, D., Wang, D. & Wu, J. A coupled surface water-groundwater multi-objective optimization framework for coordinated water-ecosystem-agriculture management in arid inland river basin. *Hydrol. Earth Syst. Sci.* **30**, 3741–3768. https://doi.org/10.5194/hess-30-3741-2026 (2026).
31. Abrahamse, W., Steg, L., Vlek, C. & Rothengatter, T. A review of intervention studies aimed at household energy conservation. *J. Environ. Psychol.* **25**, 273–291. https://doi.org/10.1016/j.jenvp.2005.08.002 (2005).
32. Xiao, C. & McCright, A. M. Gender differences in environmental concern: Revisiting the institutional trust hypothesis in a cross-national study. *Soc. Sci. Q.* **96**, 34–47. https://doi.org/10.1111/ssqu.12130 (2015).
33. Ben Romdhane, S., Lee, S. & Al-Shaebi, S. Enhancing sustainability communication among UAE's higher education students: The relationship between sustainable living knowledge and intention to live sustainably. *Sustainability* **15**, 11892. https://doi.org/10.3390/su151511892 (2023).
34. Liu, S. & Luo, L. A study on the impact of ideological and political education of ecological civilization on college students' willingness to act pro-environment: Evidence from China. *Int. J. Environ. Res.*

Public. Health. **20**, 2608. https://doi.org/10.3390/ijerph20032608 (2023).

35. Yoon, J. I., Lee, K. J. & Larson, L. R. Place attachment mediates links between pro-environmental attitudes and behaviors among visitors to Mt. Bukhan National Park, South Korea. *Front. Psychol.* **15**, 1338650. https://doi.org/10.3389/fpsyg.2024.1338650 (2024).
36. Hamann, K. R. S., Holz, J. & Reese, G. Coaching for a sustainability transition: Empowering student-led sustainability initiatives by developing skills, group identification, and efficacy beliefs. *Front. Psychol.* **12**, 623972. https://doi.org/10.3389/fpsyg.2021.623972 (2021).
37. Gan, Y., Li, S., Liu, C., Deng, J. & Gao, J. The mediating role of subjective norms and green self-efficacy in marine environmental attitudes and behaviors among Chinese university students. *Sustainability* **17**, 2224. https://doi.org/10.3390/su17052224 (2025).
38. Chen, P. et al. Water availability in China's oases decreased between 1987 and 2017. *Earth's Future*. **11** https://doi.org/10.1029/2022EF003340 (2023). e2022EF003340.
39. Yan, D. et al. Allocation of ecological water rights considering ecological networks in arid watersheds: A framework and case study of Tarim River basin. *Agric. Water Manag*. **267**, 107636. https://doi.org/10.1016/j.agwat.2022.107636 (2022).

Figures

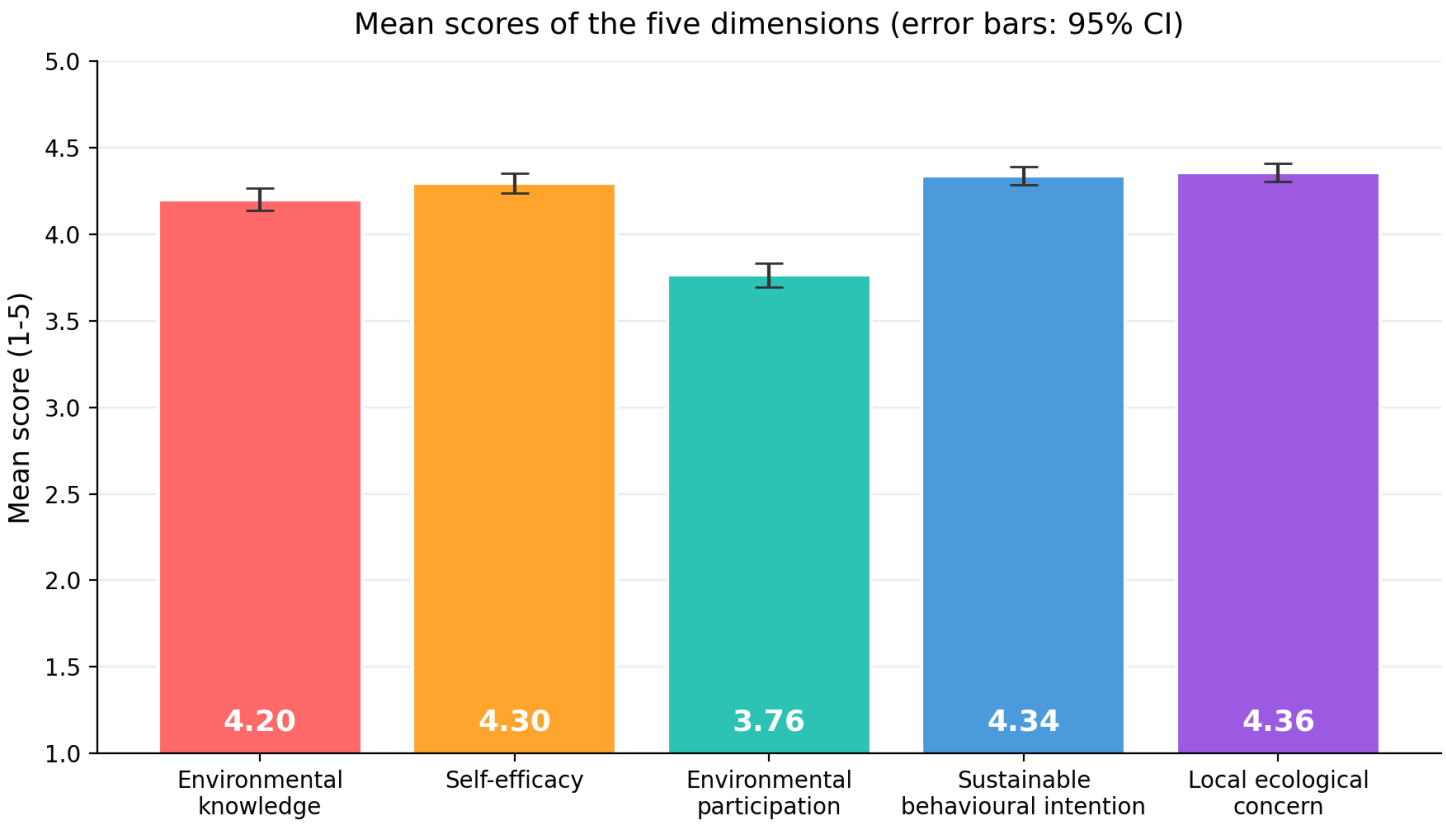


Figure 1

Mean scores of the five dimensions. Error bars indicate 95% confidence intervals; n = 659.

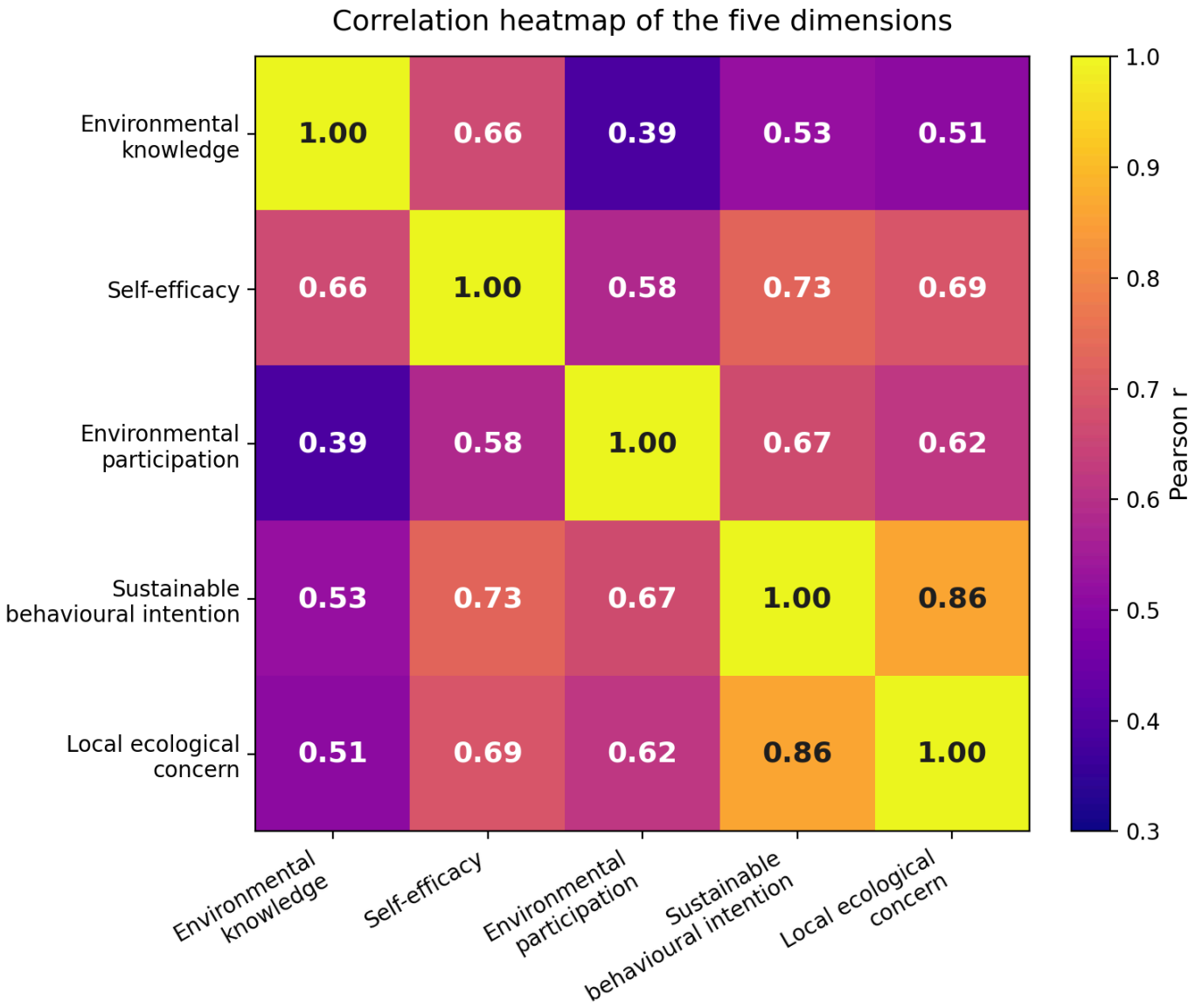


Figure 2

Heatmap of Pearson correlations among the five dimensions.

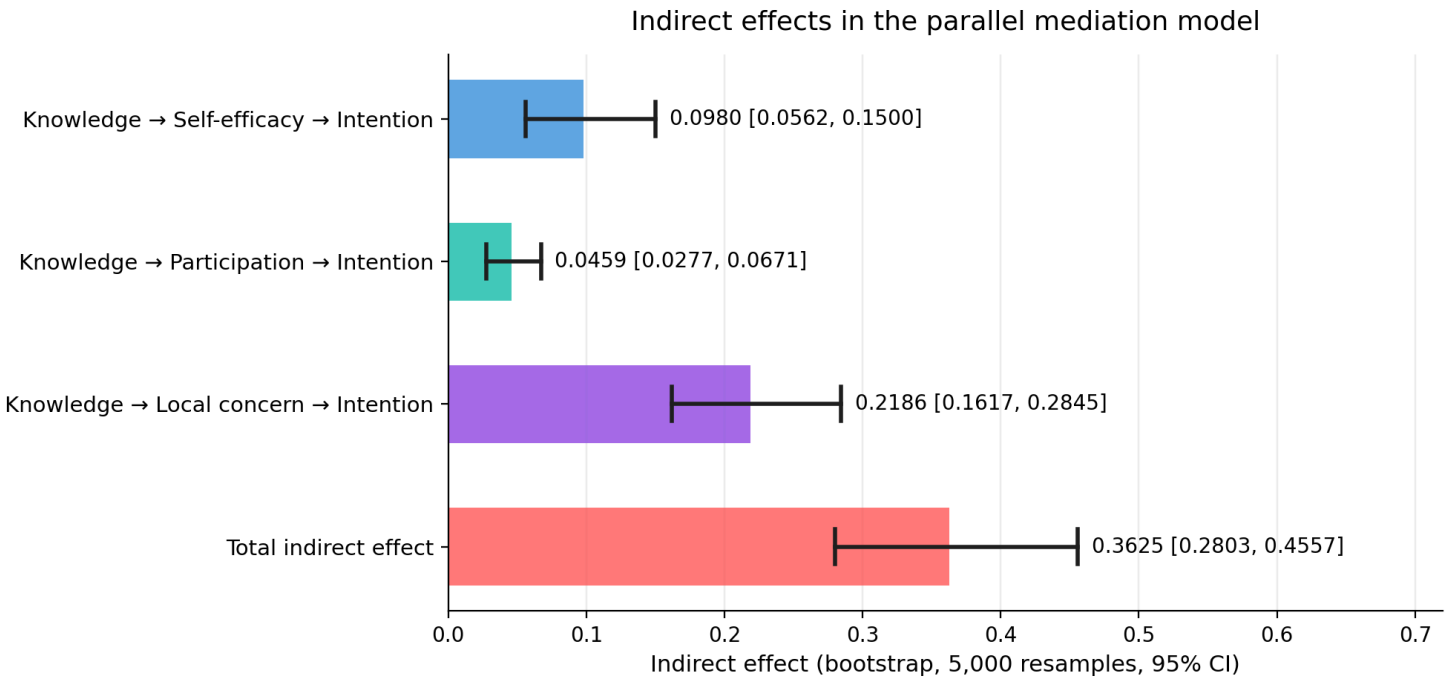


Figure 3

Indirect effects of the parallel mediation model (error bars indicate 95% bootstrap confidence intervals).

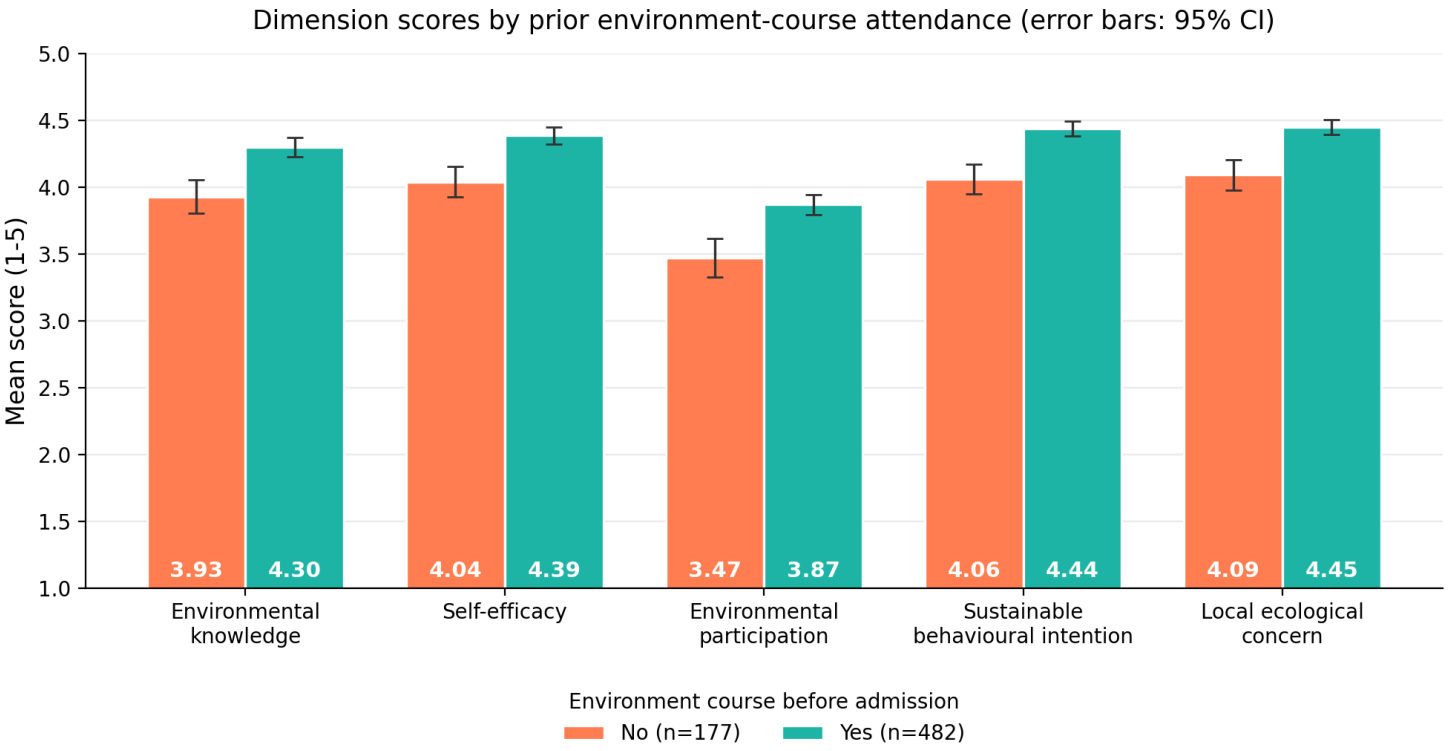


Figure 4

Dimension scores by prior environment-course attendance (error bars indicate 95% confidence intervals).

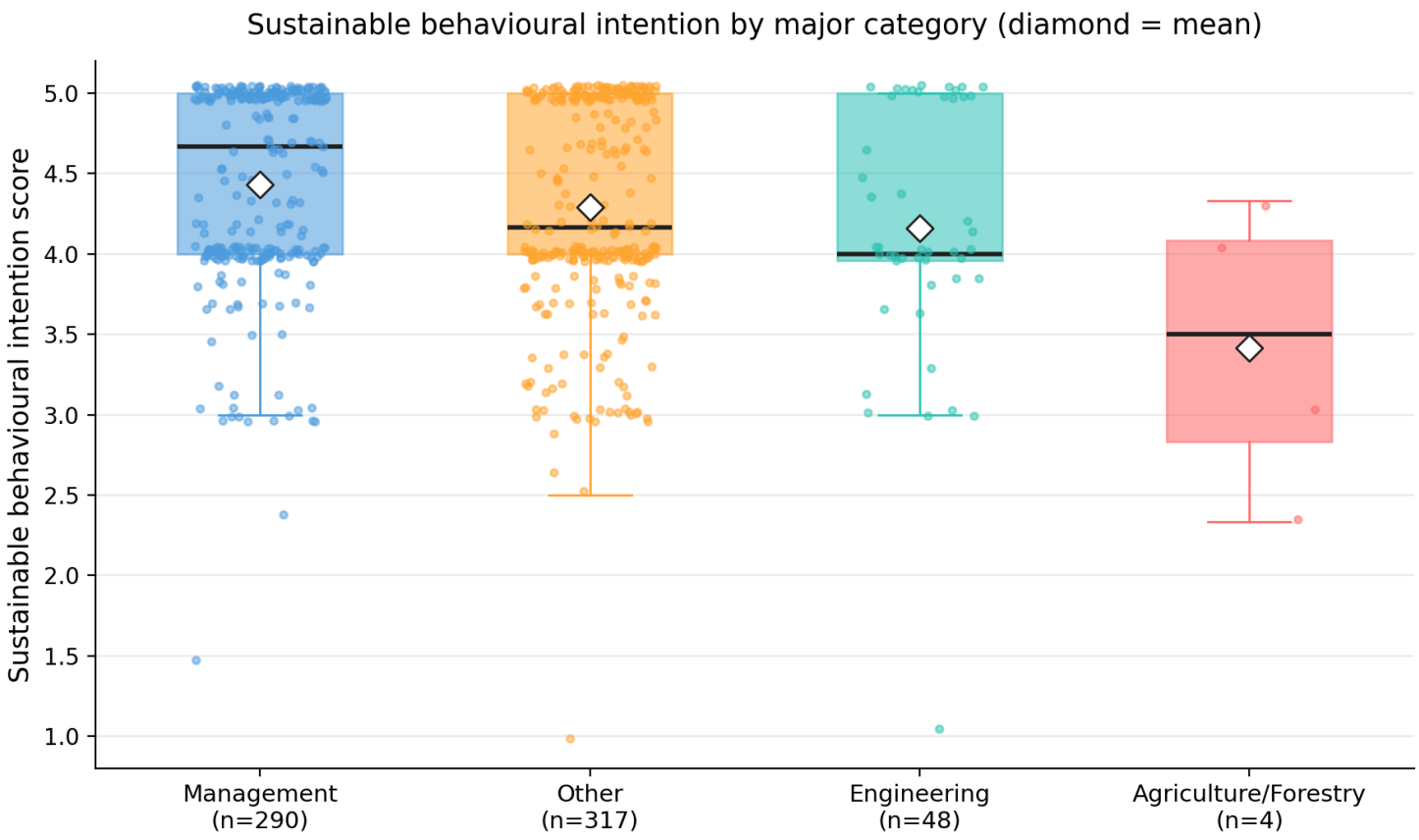


Figure 5

Distribution of sustainable behavioural intention by major category.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- Table1.png
- Table2.png
- Table3.png
- Table4.png
- Table5.png
- Table6.png