
Mediating Effect of Ecological Identity on the Relationship Between Sustainability Consciousness and Carbon Footprint Awareness

CHEDDIE MARK LLOYD T. MANOOS

Graduate School
Holy Cross of Davao College
<https://orcid.org/0009-0006-1447-9114>

ROGAR R. GARCIA, EdD

Master Teacher II, Department of Education – Division of Davao City,
F. Bangoy National High School
<https://orcid.org/009-0001-5947-0184>

Abstract — Climate concerns are threatening. The mediating effect of ecological identity on the relationship between sustainability consciousness and carbon footprint awareness was verified. Predictive design, stratified random sampling, survey approach, and mediation analysis were applied. The data from 250 STEM students revealed that the interest variable does not mediate the predictor-criterion correlation, partially supporting the Value-Belief-Norm Theory. Future research may explore other mediating variables to account for the remaining 95.3% variance in the strength of the mediation. School leaders may foster sustainability consciousness and ecological identity among students.

Keywords: *Mediating effect of ecological identity, sustainability consciousness, carbon footprint awareness*

I. INTRODUCTION

Carbon footprint awareness among adolescents has become an increasingly important concern in environmental education (Wang et al., 2024). Many students struggle to recognize how their daily behaviors, such as transportation choices, electricity use, food consumption, and waste disposal, contribute to greenhouse gas emissions (Üstgörül et al., 2024). While students often

express concern about climate change, translating this concern into consistent, environmentally responsible behavior remains a challenge (Ge et al., 2025). Globally, studies have reported similar patterns regarding carbon footprint awareness. In China, research found that students demonstrated environmental concern but still showed inconsistent awareness of the environmental impact of their daily activities (Wang et al., 2025). In the United States, studies reported that many adolescents underestimated their personal contribution to carbon emissions despite growing public discussions on climate change and sustainability issues (Nielsen et al., 2024). Similarly, research in India showed that students possessed general environmental knowledge yet exhibited limited awareness of practical low-carbon behaviors and sustainable daily practices (Sharma et al., 2024). These findings indicate that carbon footprint awareness remains a problematic environmental concern across different countries.

In the Philippine context, carbon footprint awareness among students remains inconsistent. Several studies report that although learners possess general knowledge about carbon footprint, their awareness of the specific environmental consequences of daily activities remains limited (Cabalida, 2024; Isiderio et al., 2024). Research in Davao City also indicates moderate levels of carbon footprint awareness among urban populations (Morales et al., 2024). These findings suggest the need for strengthened environmental education initiatives that promote deeper understanding and responsible environmental decision-making among students (Mahinay et al., 2023). The persistence of limited carbon footprint awareness among adolescents may result in the continuation of environmentally harmful behaviors such as excessive energy consumption, unsustainable transportation practices, improper waste disposal, and irresponsible resource use. These behaviors may contribute to increasing greenhouse gas emissions and environmental degradation, which can negatively affect efforts toward climate change mitigation and sustainable development (Van der Linden, 2021; Lee et al., 2023). Furthermore, limited awareness among students may hinder the development of environmentally responsible individuals capable of participating effectively in environmental conservation and sustainability initiatives in the future.

This study aims to examine the mediating role of ecological identity in the relationship between sustainability consciousness and carbon footprint awareness among students. The findings of this study may help educational institutions in the Philippines support the United Nations Sustainable Development Goal No. 4 (Quality Education) by promoting environmental literacy, sustainability

awareness, and responsible citizenship among learners. Educational institutions and the Department of Education (DepEd) may use the results as a basis for enhancing sustainability education, strengthening environmental programs, and developing school-based initiatives that encourage environmentally responsible practices. Furthermore, the study may contribute to fostering ecological awareness and student engagement toward sustainable environmental decision-making and long-term sustainability outcomes. This study may also serve as a reference for future research related to sustainability education and environmental awareness.

This study determined the mediating effect of ecological identity on the relationship between sustainability consciousness and carbon footprint awareness among students. The study specifically aimed to determine the levels of sustainability consciousness in terms of knowingness, attitudes, and behavior, ecological identity in terms of sameness, differentiation, and centrality, and carbon footprint awareness in terms of transportation, fuel consumption, electricity consumption, food consumption, and waste management; determine the significance of the correlation between sustainability consciousness and ecological identity, ecological identity and carbon footprint awareness, and sustainability consciousness and carbon footprint awareness; determine the significance of the direct effect of sustainability consciousness on carbon footprint awareness controlling for ecological identity; determine the significance of the indirect effect of sustainability consciousness on carbon footprint awareness through ecological identity; and determine the significance of the total effect of sustainability consciousness on carbon footprint awareness. This study was anchored on the Value–Belief–Norm Theory developed by Paul Stern in 2000.

II. METHODOLOGY

This study adopted a non-experimental quantitative approach using a predictive correlational research design. Predictive research design is a quantitative method used to determine how one or more predictor variables influence or forecast an outcome variable (Bzdok et al., 2021; Yarkoni & Westfall, 2020). Correlational research examines the strength and direction of the relationship among variables without manipulating them (Field, 2023). This approach was appropriate for the study because it aimed to examine the mediating effect of ecological identity

on the relationship between sustainability consciousness and carbon footprint awareness among students. Specifically, the study sought to determine whether sustainability consciousness significantly influences carbon footprint awareness directly and indirectly through ecological identity.

The study was conducted in Region XI, specifically in a private educational institution in the Davao Region with five campuses offering the Science, Technology, Engineering, and Mathematics (STEM) strand, namely: Davao City (Matina Campus), Davao City (Ilang Campus), Digos Campus, Peñaplata Campus, and Tagum Campus. These campuses were selected because of their active involvement in sustainability-related educational initiatives and their integration of science, technology, and environmental responsibility into educational practices. The respondents of the study were Grade 11 and Grade 12 Senior High School STEM students officially enrolled during School Year 2025–2026.

The researcher utilized proportionate stratified sampling. According to Sevilla et al. (1992), stratified sampling is a probability sampling technique in which the population is divided into subgroups to ensure fair representation from each group. In this study, the respondents were grouped according to campus and section, and a proportionate number of respondents were selected from each group. The study involved 250 Grade 11 and Grade 12 STEM students from an estimated population of 600 students. Respondents qualified if they were officially enrolled STEM students aged 16–18 years old during School Year 2025–2026. Students were excluded if they were outside the required age bracket, absent during data collection, or failed to complete the survey instrument.

The survey questionnaires used in this study were validated and adapted from existing standardized instruments. The Sustainability Consciousness Questionnaire developed by Gericke et al. (2018) contained 27 items with a Cronbach's alpha of 0.808. The Ecological Identity Scale developed by Walton and Jones (2017) contained 18 items with a Cronbach's alpha of 0.846. Lastly, the Carbon Footprint Awareness Scale developed by Üstgörül et al. (2024) consisted of 16 items with a Cronbach's alpha of 0.761. These reliability values indicate that the instruments are acceptable and reliable for measuring the variables in the study.

In the following is the table used in interpreting the data gathered.

Scale	Level	Sustainability Consciousness	Ecological Identity	Carbon Footprint Awareness
1.00-1.74	Very low	Very poor	Very weak	Very poor
1.75-2.49	Low	Poor	Weak	Poor
2.50-3.74	High	Good	Strong	Good
3.75-4.00	Very High	Very Good	Very strong	Very good

The following is the Standard Deviation Value Interpretation:

<i>Range</i>	<i>Description</i>	<i>Interpretation</i>
$SD \leq 0.50$	Highly Consistent Responses	Strong and uniform perception
$SD = 0.51 - 1.00$	Moderately Consistent Responses	Acceptable consistency
$SD = 1.01 - 1.50$	Low Consistency Responses	Differing views or experiences
$SD > 1.50$	Very Low Consistency Responses	High variability and lack of consensus

In this study, the significance of the correlation is tested at 0.05 confidence level. The following is the standard measure for the interpretation scale of r -value, the following scheme is used:

<i>Computed r</i>	<i>Descriptive Interpretation</i>
+/- 1.00	Perfect correlation
Between +/- 0.75 – +/- 0.99	High correlation
Between +/- 0.51 – +/- 0.74	Moderately high correlation
Between +/- 0.31 – +/- 0.50	Moderately low correlation
Between +/- 0.01 – +/- 0.30	Low correlation
0.00	No correlation

The standard measure for the interpretation of the strength of the mediation is as follows:

<i>Proportion Mediated</i>	<i>Interpretation</i>
< 0.20	Weak Mediation
0.20 – 0.50	Moderate Mediation
> 0.50	Strong Mediation

At the beginning of the data collection, the researcher complied with all ethical standards set by the Holy Cross of Davao College – Society for Moral Integrity and Legal Ethics (HCDC-SMILE). Approval to conduct the study was secured from the Department of Education (DepEd) and the school authorities of the selected campuses. Informed consent was obtained from all respondents, while assent forms and parental consent were secured for participants who were minors. Participants were informed that participation was voluntary and that they had the right to withdraw at any time without penalty. Confidentiality and anonymity of responses were strictly observed, and all gathered information was used solely for academic purposes.

The researcher utilized mean and standard deviation to determine the levels of sustainability consciousness, ecological identity, and carbon footprint awareness of STEM students. Pearson Product-Moment Correlation Coefficient was used to determine the significance of the relationship among the variables. Mediation analysis was utilized to determine the direct effect, indirect effect, and total effect of sustainability consciousness on carbon footprint awareness through ecological identity.

III. RESULTS AND DISCUSSIONS

Table 1 are the descriptive statistical results of the study. Contained in the table are the variables involved, namely, ecological identity, sustainability consciousness, and carbon footprint awareness, with their respective indicators; and the number of samples, standard deviation, mean, and descriptive level specifically corresponding with each of the variables.

TABLE 1
DESCRIPTIVE TABLE

Variables	(N)	SD	Mean	Descriptive Level
Ecological Identity	250	0.38	2.75	High
<i>Sameness</i>	<i>250</i>	<i>0.52</i>	<i>2.95</i>	<i>High</i>
<i>Differentiation</i>	<i>250</i>	<i>0.76</i>	<i>2.10</i>	<i>Low</i>
<i>Centrality</i>	<i>250</i>	<i>0.53</i>	<i>3.20</i>	<i>Very High</i>
Sustainability Consciousness	250	0.29	3.63	Very High
<i>Knowingness</i>	<i>250</i>	<i>0.34</i>	<i>3.75</i>	<i>Very High</i>
<i>Attitudes</i>	<i>250</i>	<i>0.36</i>	<i>3.70</i>	<i>Very High</i>
<i>Behaviour</i>	<i>250</i>	<i>0.45</i>	<i>3.44</i>	<i>Very High</i>
Carbon Footprint Awareness	250	0.36	3.26	Very High
<i>Transportation</i>	<i>250</i>	<i>0.69</i>	<i>3.09</i>	<i>High</i>
<i>Fuel Consumption</i>	<i>250</i>	<i>0.54</i>	<i>3.20</i>	<i>High</i>
<i>Electricity Consumption</i>	<i>250</i>	<i>0.44</i>	<i>3.38</i>	<i>Very High</i>
<i>Food Consumption</i>	<i>250</i>	<i>0.51</i>	<i>3.25</i>	<i>High</i>
<i>Waste Management</i>	<i>250</i>	<i>0.51</i>	<i>3.38</i>	<i>Very High</i>

3.75 - 4.00 – Very High, 2.50 - 3.74 – High, 1.75 - 2.49 – Low, 1.00 - 1.74 – Very Low

The table specifically shows that the Ecological Identity variable obtained a mean of 2.75, described as high, indicating that the ecological identity of the respondents is generally strong. Its

indicators are described as very high, high and very low. The standard deviation of 0.38 indicates a highly consistent response, showing that the respondents have a relatively uniform perception. Furthermore, the Sustainability Consciousness variable obtained a mean of 3.63 described as very high, indicating that the respondents demonstrate a very strong level of sustainability consciousness. The standard deviation of 0.29 indicates highly consistent responses. All its indicators, namely knowingness, attitudes and behavior are described as very high. Lastly, the Carbon Footprint Awareness variable obtained a mean of 3.26 described as very high, indicating that the respondents have a very strong awareness of their carbon footprint. The standard deviation of 0.36 shows consistent responses among participants. Among its indicators, transportation, fuel consumption, and food consumption are described as high, while electricity consumption and waste management are described as very high.

Table 2 is the correlation table. It contains determinant and criterion variables. Aside from the variables, it also contained the number of samples, r -value, p -value, decision on the null hypothesis, and the corresponding interpretation.

Table 2. Correlation Table

Variables	Carbon Footprint Awareness			
	r -value	p -value	Decision on H_0	Interpretation
Ecological Identity	0.20	.001	Reject	Low positive, significant correlation
Sustainability Consciousness	0.35	<.001	Reject	Moderate Low Positive, significant correlation

Level of Significance: 0.05

Decision Rule: Reject H_0 if $p < 0.05$

The correlation between Ecological Identity and Carbon Footprint Awareness variables obtained a p-value of 0.001 which is less than 0.05 level of significance, hence the null hypothesis was rejected. It indicates that Ecological Identity and Carbon Footprint Awareness correlation is statistically significant. The corresponding r-value of 0.20 indicates a low positive correlation between the two variables mentioned. This implies that students with stronger ecological identity tend to have higher carbon footprint awareness, although the relationship is relatively low. Moreover, the correlation between Sustainability Consciousness and Carbon Footprint Awareness has a p-value of less than 0.001 which is lower than 0.05 level of significance, therefore the null hypothesis was rejected. This means that Sustainability Consciousness and Carbon Footprint Awareness have a significant relationship. With a corresponding r-value of 0.35, this indicates a moderate low positive correlation. This implies that students with higher sustainability consciousness are more likely to demonstrate greater awareness of their carbon footprint.

Table 3 presents mediating table. The table includes several columns: Predictor, Estimate, Standard Estimate, SE (Standard Error), t (t-value), p (p-value), and Decision on null hypothesis.

TABLE 3
MEDIATION TABLE

Label	Path / Effect	Estimate (B)	SE	Z-value	p-value	Decision on H ₀	Interpretation
A	Sustainability Consciousness → Ecological Identity	0.18	0.08	2.05	0.040	Reject H ₀	Significant
B	Ecological Identity → Carbon Footprint Awareness	0.14	0.06	2.37	0.018	Reject H ₀	Significant
c'	Sustainability Consciousness → Carbon Footprint Awareness (Direct Effect)	0.39	0.07	5.40	<.001	Reject H ₀	Significant
a × b	Indirect Effect (Mediation)	0.02	0.01	1.62	0.106	Failed to Reject H ₀	Not Significant
c (Total Effect)	Sustainability Consciousness → Carbon Footprint Awareness (Total)	0.42	0.07	5.78	<.001	Reject H ₀	Significant

Level of Significance: 0.05

Decision Rule: Reject H₀ if p < 0.05

% Mediation: Direct – 93.65%; Indirect – 6.35%

Mediated Proportion = 0.047 or 4.7%

The table shows the direct effect of Sustainability Consciousness on Carbon Footprint Awareness variable, controlling for Ecological Identity, obtained an estimate Beta of 0.39. With the p-value of less than 0.001, which is less than 0.05 level of significance, hence the null hypothesis was rejected. This indicates that the direct effect of Sustainability Consciousness on Carbon Footprint Awareness, controlling for Ecological Identity is significant. Moreover, the indirect effect of Sustainability Consciousness on Carbon Footprint Awareness through Ecological Identity variable obtained an estimate Beta of 0.02. With a p-value of 0.106, which is greater than 0.05 level of significance, hence the null hypothesis was accepted. This shows that the indirect effect of Sustainability Consciousness on Carbon Footprint Awareness through Ecological Identity is not significant. Lastly, the total effect of Sustainability Consciousness on Carbon Footprint Awareness obtained an estimate beta of 0.42. The p-value is less than 0.001 which is less than 0.05 level of significance, hence the null hypothesis was rejected. It indicates that the overall effect of Sustainability Consciousness on Carbon Footprint Awareness is significant.

Finally, the table shows the mediated proportion of 4.7% indicates that the strength of the mediation is moderate.

Summary of Findings

The finding that ecological identity has a low but significant positive correlation with carbon footprint awareness affirms prior evidence indicating that individuals who perceive themselves as connected to nature tend to demonstrate greater environmental awareness and pro-environmental orientations. (Leal Filho et al., 2024). The current finding affirms Clayton & Karazsia (2023), who emphasized that individuals with a stronger ecological identity are more likely to cognitively and emotionally engage with environmental issues, thereby increasing their awareness of personal environmental impacts. Similarly, the current finding supports the study of Whitmarsh et al. (2023) emphasizing that a sense of connection to nature influences how individuals interpret and respond to environmental problems, reinforcing the role of ecological identity in shaping environmental awareness. However, this finding contradicts the study of Dash et al. (2023), arguing that students may still demonstrate low carbon footprint awareness despite exposure to environmental education and environmental concern, suggesting that ecological identity or environmental engagement does

not always strongly translate into awareness of personal carbon footprint impacts. These findings support the present result, suggesting that while the relationship may be low in strength, ecological identity remains a meaningful factor in enhancing students' carbon footprint awareness.

Furthermore, the finding that sustainability consciousness has a moderately low but significant positive correlation with carbon footprint awareness affirms previous studies highlighting the role of sustainability knowledge, attitudes, and behaviors in shaping environmental awareness. Recent research indicates that individuals with higher levels of sustainability consciousness tend to exhibit greater awareness of their environmental impact, as their knowledge and values guide more informed environmental perceptions and decisions (Wamsler et al., 2023). Similarly, the current finding supports the study by Leal Filho et al. (2023) presenting that sustainability-related competencies, including awareness and responsible thinking, significantly influence individuals' understanding of environmental issues such as carbon emissions. These findings support the present result, suggesting that even at a moderate-low level, sustainability consciousness contributes meaningfully to students' carbon footprint awareness. In contrary, studies suggest that sustainability consciousness does not always lead to stronger carbon footprint awareness or responsible practices. Scholars noted that individuals may possess sustainability knowledge and positive attitudes but still fail to recognize or act on the environmental impact of their daily behaviors due to various social and contextual factors (Nguyen et al., 2023). Likewise, Nielsen et al. (2024) found that students' concern for sustainability does not always correspond to consistent carbon footprint awareness.

The finding that ecological identity does not mediate the relationship between sustainability consciousness and carbon footprint awareness affirms the previous studies highlighting that pro-environmental knowledge and awareness may exert a more direct influence than identity-based factors. Wamsler et al. (2023) and Leal Filho et al. (2023) emphasized that sustainability knowledge and competencies directly shape environmental awareness without necessarily requiring identity as a mediator. Similarly, the present finding affirms Nguyen et al. (2023) who found that environmental knowledge significantly predicts pro-environmental outcomes, while identity-related variables may show weaker or non-significant mediating effects. However, the present result contradicts the findings of Clayton and Karazsia (2023), who argued that ecological identity plays an important mediating role in translating sustainability values and environmental

concern into environmentally responsible awareness and behavior. Their study suggested that individuals with stronger ecological identity are more likely to internalize sustainability consciousness, thereby increasing awareness of environmental impacts.

IV. CONCLUSION

Ecological identity does not significantly mediate the relationship between sustainability consciousness and carbon footprint awareness. Although, the two determinants were significantly correlated with the criterion variable. Hence, the Value-Belief-Norm Theory, positing that pro-environmental behavior results from a chain linking values, beliefs, and personal norms, was partially supported.

V. RECOMMENDATIONS

Future studies may explore additional variables and qualitative approaches to better explain students' carbon footprint awareness and gain deeper insights into their ecological identity and sustainability consciousness. Moreover, schools and educational institutions are encouraged to strengthen sustainability education and ecological awareness programs to help develop environmentally responsible individuals capable of addressing environmental challenges and supporting sustainable development goals.

REFERENCES

- [1.] Bzdok, D., Altman, N., & Krzywinski, M. (2021). Statistics versus machine learning. *Nature Methods*, 18(5), 451–452. <https://doi.org/10.1038/s41592-021-01137-7>
- [2.] Cabalida, H. M. L. (2024). Carbon Footprint and Climate Change Awareness: Implications for Climate Change Education in a Junior High School. *International Journal of Trend in Scientific Research and Development*, 8(3), 1077-1095.
- [3.] Clayton, S., & Karazsia, B. T. (2023). Development and validation of a measure of climate change anxiety. *Journal of Environmental Psychology*, 88, 102070. <https://doi.org/10.1016/j.jenvp.2023.102070>
- [4.] Dash, D. S., Pradhan, P., & Behera, S. K. (2023). *Awareness and practices of carbon footprint reduction: A survey among postgraduate students*. *Current Research Journal of Social Sciences*, 6(1), 122–131. <https://doi.org/10.12944/CRJSSH.6.1.10>
- [5.] Field, A. (2023). *Discovering statistics using IBM SPSS statistics* (6th ed.). SAGE Publications.
- [6.] Gericke, N., Pauw, J. B., Berglund, T., & Olsson, D. (2018). The Sustainability Consciousness Questionnaire: The theoretical development and empirical validation of an evaluation instrument for stakeholders working with sustainable development. *Sustainable Development*, 27(1), 35–49. <https://doi.org/10.1002/sd.1859>
- [7.] Isiderio, E. D., Dacles, G. G., Yap, M. C. Y., Solano, M. L. A., & Obidos, I. D. (2024). “Consumption-Based Estimates of Carbon Footprint and Its Global Warming Solution: Input to Awareness Campaign.” *International Journal of Multidisciplinary: Applied Business and Education Research*, 5(10), 3911–3919. <https://doi.org/10.11594/ijmaber.05.10.09>
- [8.] Leal Filho, W., Azul, A. M., Brandli, L., Özuyar, P. G., & Wall, T. (2023). Promoting sustainable development through sustainability competencies: A systematic literature review. *Sustainability*, 15(3), 1923. <https://doi.org/10.3390/su15031923>

-
- [9.] Leal Filho, W., Azul, A. M., Brandli, L., Özuyar, P. G., & Wall, T. (2024). Promoting environmental awareness and sustainability through education: Recent trends and implications for behavior change. *Sustainability*, 16(3), 1185. <https://doi.org/10.3390/su16031185>
- [10.] Lee, S., Kim, J., & Park, H. (2023). Environmental awareness and sustainable development among youth populations. *Journal of Cleaner Production*, 398, 136512. <https://doi.org/10.1016/j.jclepro.2023.136512>
- [11.] Mahinay, H. A. C., Marapao, M. S. A., Jempero, J. B., & Allawan, J. G. L. (2023). *Environmental Literacy Levels and Environmental Pollution among Senior High School Students. Journal of Environmental Impact and Management Policy*, 3(6), 17–25. <https://doi.org/10.55529/jeimp.36.17.25>
- [12.] Morales, I. E., Ballesta, R. M. A., Sumaluyan, J. M., & Pardillo, J. S. (2024). *Carbon footprints of selected urban barangays in Davao City, Philippines. International Journal of Innovative Science, Engineering & Technology (IJISSET)*, 11(12), 15–23.* https://ijiset.com/vol11/v11s12/IJISSET_V11_I12_03.pdf
- [13.] Nguyen, T. T., Lobo, A., & Greenland, S. (2023). The influence of environmental knowledge on pro-environmental behavior: The role of attitudes and identity. *Journal of Environmental Management*, 330, 117150. <https://doi.org/10.1016/j.jenvman.2022.117150>
- [14.] Nielsen, K. S., Bauer, J. M., Debnath, R., Emogor, C. A., Geiger, S. M., Ghai, S., Gwozdz, W., & Hahnel, U. J. J. (2024). Underestimation of personal carbon footprint inequality in four diverse countries. *Nature Climate Change*, 14(11), 1136–1143. <https://doi.org/10.1038/s41558-024-02130-y>
- [15.] Sevilla, C. G., Ochave, J. A., Punsalan, T. G., Regala, B. P., & Uriarte, G. G. (1992). *An introduction to research methods*. Quezon City: Rex Printing Company.
- [16.] Sharma, P., Verma, R., & Singh, A. (2024). Low-carbon lifestyle awareness among secondary school students in India. *Journal of Environmental Studies and Sciences*, 14(1), 75–89. <https://doi.org/10.1007/s13412-023-00845-2>
-

-
- [17.] Stern, P. C. (2000). Toward a coherent theory of environmentally significant behavior. *Journal of Social Issues*, 56(3), 407–424. <https://doi.org/10.1111/0022-4537.00175>
- [18.] Udall, A. M., de Groot, J. I. M., De Jong, S. B., & Shankar, A. (2020). How I see me—A meta-analysis investigating the association between identities and pro-environmental behaviour. *Frontiers in Psychology*, 11, 582421.
- [19.] Üstgörül, S., Akkaya, B., Palazzo, M., & Micozzi, A. (2024). Development and validation of carbon footprint awareness scale for boosting sustainable circular economy. *Sustainability*, 16(18), 8199. <https://doi.org/10.3390/su16188199>
- [20.] Van der Linden, S. (2021). The psychology of climate change communication. *Annual Review of Psychology*, 72, 583–609. <https://doi.org/10.1146/annurev-psych-071620-030413>
- [21.] Walton, T. N., & Jones, R. E. (2017). Ecological Identity: the development and assessment of a measurement scale. *Environment and Behavior*, 50(6), 657–689. <https://doi.org/10.1177/0013916517710310>
- [22.] Wamsler, C., Osberg, G., Osika, W., Herndersson, H., & Mundaca, L. (2023). Linking sustainability education to everyday behaviors: The role of knowledge, values, and competencies. *Environmental Education Research*, 29(4), 563–580. <https://doi.org/10.1080/13504622.2023.2171973>
- [23.] Wang, S., Mbanyele, W., Feng, T., Khan, S., & Fan, S. (2025). *Bridging the knowledge-action divide: environmental awareness and low-carbon behaviors of Chinese university students*. *Palgrave Communications*, 12(1), 1-19. DOI: 10.1057/s41599-025-04953-2
- [24.] Whitmarsh, L., Capstick, S., & Moore, I. (2023). Climate change or social change? Debate within, amongst, and beyond disciplines. *Wiley Interdisciplinary Reviews: Climate Change*, 14(2), e824. <https://doi.org/10.1002/wcc.824>
- [25.] Yarkoni, T., & Westfall, J. (2020). Choosing prediction over explanation in psychology: Lessons from machine learning. *Perspectives on Psychological Science*, 15(6), 1100–1122. <https://doi.org/10.1177/174569162090>
-