BIO-INOVED
Jurnal Biologi-Inovasi Pendidikan
Volume 8, Issue 2, June 2026 page. 213-220

P-ISSN : 2684-9062 | E-ISSN : 2714-9803
https://ppjp.ulm.ac.id/journal/index.php/bino
DOI: 10.20527/bino.v8i2.25772

Implementing place-based education to enhance ecological empathy and conservation intention

Bimo Aji Nugroho [(1)] *, Hery Fajeriadi [(2)]

[(1)] Department of Biology Education, Faculty of Teacher Training and Education, Universitas Borneo, Tarakan, North Kalimantan, Indonesia
[(2)] Department of Biology Education, Faculty of Teacher Training and Education, Universitas Lambung Mangkurat, Banjarmasin, South Kalimantan, Indonesia

** Corresponding Author Email: bimoajinugroho29@borneo.ac.id*

Article Information

Keyword:
Place-based education;
Ecological empathy;
Conservation intent;
Environmental education

Kata Kunci:
Pendidikan berbasis tempat;
Empati ekologis; Niat konservasi; Pendidikan lingkungan

History:
Received : 27/03/2026
Revised : 16/05/2026
Accepted : 08/06/2026
Published : 15/06/2026

Abstract

Environmental education is often limited to cognitive understanding, creating a gap between environmental knowledge and actual conservation actions. This research is crucial due to the decrease in empathy and enthusiasm for conservation efforts among students, which stems from a learning process that is non-contextual and limited to the classroom. This research aims to test the effectiveness of the Place-Based Education (PBE) paradigm in enhancing students' ecological empathy and conservation aspirations. This pre-experimental study used a one-group pretest-posttest design with 33 participants from the Biology Education Study Programme at the University of Borneo Tarakan. The intervention was carried out through direct observation in the Mangrove and Proboscis Monkey Conservation Area in Tarakan City. The collected data were examined using paired sample t-tests, effect size calculations (Cohen's d), and standardised gain (N-gain). The research findings show a substantial increase ($p < 0.001$) in both variables, accompanied by a very large effect size. The increase in conservation intention (N-Gain = 0.66) was observed to exceed the increase in ecological empathy (N-Gain = 0.35). In short, PBE-based learning is capable of transforming passive information into active commitments and encouraging action-oriented behaviour. The implementation of PBE in the future can be applied as a pedagogical approach to develop sustainability traits. A long and sustained intervention process is required to deeply cultivate empathy.

Abstrak *Pendidikan lingkungan sering kali terbatas pada pemahaman kognitif, menciptakan kesenjangan antara pengetahuan lingkungan dan tindakan konservasi yang nyata. Penelitian ini sangat penting karena menurunnya empati dan antusiasme terhadap upaya konservasi di kalangan siswa, yang disebabkan oleh proses pembelajaran yang tidak kontekstual dan terbatas di dalam kelas. Penelitian ini bertujuan untuk menguji efektivitas paradigma Pendidikan Berbasis Tempat (PBE) dalam meningkatkan empati ekologis dan aspirasi konservasi siswa. Studi preeksperimental ini menggunakan desain pretest-posttest satu kelompok dengan 33 peserta dari Program Studi Pendidikan Biologi Universitas Borneo Tarakan. Intervensi dilakukan melalui observasi langsung di Kawasan Konservasi Mangrove dan Bekantan di kota Tarakan. Data yang dikumpulkan diperiksa menggunakan uji t sampel berpasangan, perhitungan ukuran efek (d Cohen), dan keuntungan terstandarisasi (N-gain). Temuan penelitian menunjukkan peningkatan substansial ($p < 0.001$) pada kedua variabel, disertai dengan ukuran efek yang sangat besar. Ditemukan bahwa peningkatan dalam niat konservasi (N-Gain = 0.66) melebihi peningkatan dalam empati ekologis (N-Gain = 0.35). Singkatnya, pembelajaran berbasis PBE mampu mengubah informasi pasif menjadi komitmen aktif dan mendorong perilaku yang berorientasi pada tindakan. Implementasi PBE di masa depan dapat diterapkan sebagai pendekatan pedagogis untuk mengembangkan sifat keberlanjutan. Un proceso de intervención largo y sostenido es necesario para cultivar profundamente la empatía.*

© 2026 BIO-INOVED : Jurnal Biologi-Inovasi Pendidikan

A. Introduction

Higher education confronts a dual challenge: transferring factual knowledge and fostering sustainability competencies, which encompass an internalization of values and attitudes (Cebrián et al., 2015; Sposab & Rieckmann, 2024). There is a significant criticism that the current learning process fails to integrate cognitive and affective domains. Consequently, students might have sufficient theoretical knowledge yet frequently lack motivation for conservation action. This phenomenon arises from the perception that sustainability issues are devoid of personal significance or direct relevance to students' lives (Bandhu et al., 2024). The absence of affective abilities, especially empathy, in the science curriculum has hindered students' social-emotional development (Huang & Lajoie, 2023), resulting in diminished moral responses to environmental damage.

Empathy in conservation discourse is a capacity to understand and share emotional experiences and has since been recognized as a key variable (Sobel, 2004). The learning process ought to emphasize fundamental human characteristics, like empathy and intention, instead of focusing exclusively on knowledge acquisition and academic achievement. This process works through perspective-taking, especially when confronted with land conversion data resulting in the loss of endemic flora and fauna. Empathy enables students to process information as statistical data while also understanding its existential impact on animal habitats. Empathy is fundamental to developing long-term environmental concern, not just an addition to the learning process.

The decline in empathy is worsened through the prevalence of decontextualized teaching practices. Biology cannot be taught exclusively through textbooks and preserved specimens in laboratories. (Soga & Gaston, 2016) describe the phenomenon of separation just like the extinction of experience, where the lack of direct interaction with nature impedes the development of ecological empathy (Raymond et al., 2025). The learning process occurs solely in the classroom, contributing to students' low empathy and awareness of the effects (Verhoeven et al., 2021). Students cannot directly observe the effects or dangers to the habitat. This learning process fosters psychological distance, potentially leading to students who are indifferent to local environmental threats (Shen & Wang, 2023).

An approach is required for integrating students with environmental realities. Place-Based Education (PBE) immerses students in their local socio-ecological context, encouraging the integration of knowledge and attitudes (Smith & Sobel, 2010). The efficacy of PBE has been widely recognized; however, research primarily emphasizes cognitive outcomes of long-duration programs (Cincera et al., 2019; Darling et al., 2020; Gruenewald, 2005; Hamilton & Marckini-Polk, 2023; Howley et al., 2011; Powers, 2004; Sgouros & Stirn, 2016; Yemini et al., 2025). Seeing the condition of mangroves which are continuously under pressure due to land clearing such as fish ponds and housing as well as fishing boat activities (Nugroho & Putri, 2024), it is necessary to carry out learning that brings students closer to the damaged environment. The analysis reveals that PBE's achievements continue to prioritise cognitive improvements and long-term application. It is necessary to see how PBE can enhance effectiveness in terms of empathy. Additionally, this research was conducted in a short period, adding a perspective, especially if one intends to implement it in a short time. This study tests a place-based brief intervention model in the Tarakan mangrove ecosystem to provide empirical evidence on the causal relationship between immersive pedagogy and the development of essential sustainability character.

B. Material and method

This study employs a quantitative method with a pre-experimental design, specifically the One-Group Pretest-Posttest Design. This design was considered appropriate for evaluating preliminary changes in affective variables following a short-term educational intervention. Thus, selection of subjects or the use of a group of controls is not feasible. The research implementation structure can be described as O1X O2, where O1 represents the first measurement (pre-test) for baseline data on students' empathy and intentions, X indicates the Place-Based Education (PBE) intervention conducted in the mangrove ecosystem, and O2 is the final measurement (post-test) following the completion of the learning cycle. The intervention procedure begins with the alignment of the curriculum in the classroom through the provision of a theoretical foundation on mangrove ecosystems and environmental ethics. Next, students engage in immersive learning in the KKMB area through the phase of inquiry into place to observe the characteristics of mangroves and the behavior of the endemic proboscis monkey (*Nasalis larvatus*). During the exploration process, students are directed to identify environmental challenges, such as real anthropogenic threats like the accumulation of urban plastic waste and habitat fragmentation. In order to build student ownership and skills, students independently fill out group reflection journals in the field to analyze the relationship between local habitat degradation and the observed threat of wildlife extinction. In the post-field stage, students engage in group discussions (collaborate with peers) to synthesize field findings, link ecological aspects with the socio-economic dynamics of the local Tarakan community, and formulate commitments to real conservation actions (conative expression). Evaluation of the success of the intervention (measuring outcomes and successes) is conducted quantitatively

through a one-group pretest-posttest design by comparing scores before and after the treatment using the Ecological Empathy Scale and Pro-Conservation Behavior Intention Scale.

Time and place of research

This research will occur in three meetings during the first semester of the 2025/2026 academic year.

The pre-test (T1) was conducted before the first meeting, which addressed environmental ethics concepts and conservation behavior. Field intervention (PBE) occurred in the second meeting, involving planned observations of the mangrove forest ecosystem, fauna, and existing threats by students. During the third meeting, students presented their field findings and conducted synthesis and evaluation. A post-test (T2) was given at the session's final stage. The T2 placement at the cycle's end measures the intervention's learning impact.

The location for the treatment place (meeting 2) will be the Mangrove and Proboscis Monkey Conservation Area (KKMB) in Tarakan City. The location was chosen for its role as an important pedagogical variable in Place-Based Education design. The KKMB was selected for three reasons: (1) Its relevance, allowing students to encounter endemic vertebrate fauna (Nasalis larvatus) and typical mangrove fauna (Aves, Reptiles); (2) Its design, featuring an ironwood walkway under the dense canopy, which fosters a multisensory learning environment essential for stimulating the affective domain and ecological empathy; and (3) Its function as a location for socio-ecological conflict, enabling students to observe anthropogenic threats directly. The setting establishes a solid context for applying the environmental ethics concepts from Meeting 1.

Population and sample

The population in this study is the students of the Biology Education Study Programme at the University of Borneo Tarakan. The average age of the population ranges from 20 years, with 3 males and 30 females who are taking the vertebrate course in the odd semester of the 2025/2026 academic year. Considering the population size (N=33), the sampling technique used is a saturated sample. The selection of this technique is based on the consideration of maximising data representation from the available learning group and minimising selection bias. The inclusion criteria for participants include the status of being an actively enrolled student in the course and the willingness to attend the entire series of interventions (three meetings) and complete the pre-test and post-test instruments in full.

Figure 1 Place-based education observation location

Data collection instruments and techniques

his study applied a non-test instrument for data collection, using a self-report questionnaire with two primary constructs. The ecological empathy scale measures students' emotional attachment to nature through ten questions rated on a scale of seven, which ranges from one "Highly Disagree" to seven "Highly Agree" (Tam, 2013). The second instrument is the Pro-Conservation Behavior Intention Scale, which assesses students' likelihood of future involvement with conserving the environment. It includes seven statements rated on a 5-point Likert scale, which ranges from one "Very Unlikely" to five "Very Likely" (Ugulu, 2013). All components of the instrument have been verified for content reliability and validity using cronbach's alpha coefficient. The instrument is deemed suitable if the reliability coefficient exceeds the standard threshold ($\alpha > 0.70$).

Data analysis techniques

Data analysis utilized descriptive and inferential methods via jamovi version 2.6 to address the research hypotheses. The analysis commenced with a normality test using the Shapiro-Wilk Test to assess data distribution, given the small sample size ($N < 50$). The hypothesis regarding the difference in mean scores before and after the intervention was tested using the Paired Sample t-test for normally distributed data or the Wilcoxon Signed-Rank Test if normality was not met, with a significance level of $\alpha = 0.05$. Further analysis will measure the effectiveness of the intervention more thoroughly by calculating the

Normalised Gain (N-Gain) score to categorise its effects on the tested variables as High, Medium, or Low. Additionally, the Effect Size will be calculated using Cohen's d formula to determine the practical impact of the place-based education intervention on students' empathy and conservation intention variables.

C. Results and discussion

Research shows the effectiveness of the Place-Based Education model in enhancing students' ecological empathy and conservation intentions. Data analysis took place over two stages: descriptive statistical analysis to observe score changes and inferential analysis using parametric tests to assess significance and measure the intervention's impact. The experiment's results suggest an upward trend in the averages of both variables. The ecological empathy variable recorded an average pre-test score of 36.8 and a post-test score of 47.0 at the final measurement. The conservation intention variable showed an increase, with the average score rising from 20.4 in the pre-test to 29.7 in the post-test.

Table 1 Summary of descriptive statistics of pre-test and post-test scores

Variable	Data	N	Mean	Std. Deviation	Min	Max
Ecological Empathy	Pre-test	33	36.8	11.9	11.0	57.0
	Post-test	33	47.0	11.6	21.0	67.0
Conservation Intention	Pre-test	33	20.4	2.62	16.0	26.0
	Post-test	33	29.7	2.88	24.0	35.0

Table 2 Results of the paired sample t-test and effect size

Variable	Data Pair	t	df	Sig. (2-tailed)	Cohen's d	Effect Category
Ecological Empathy	Pre - Post	32.9	32.0	< 0.001	5.7	Very large
Conservation Intention	Pre - Post	91.3	32.0	< 0.001	15.8	Very large

The paired sample t-test was applied to assess the significance of the score improvement (Table 2). The results of the analysis showed a significant difference between the pre-test and post-test for both variables. The ecological empathy variable provided a t-value of 32.9 (32) with a significance level of $p < 0.001$. The Conservation Intention variable had a t-value of 91.3 (32) with $p < 0.001$. The significance value is below 0.05, which contributes to the elimination of the null assumption and confirms the learning intervention's effect. Figure 2 illustrates the dynamics of score change, emphasizing the gap between the beginning and final conditions. This change reflects an improvement in students' affective profiles following the intervention. The standard deviation of the data in Table 1 indicates an even distribution, suggesting that competence increased uniformly among the research subjects.

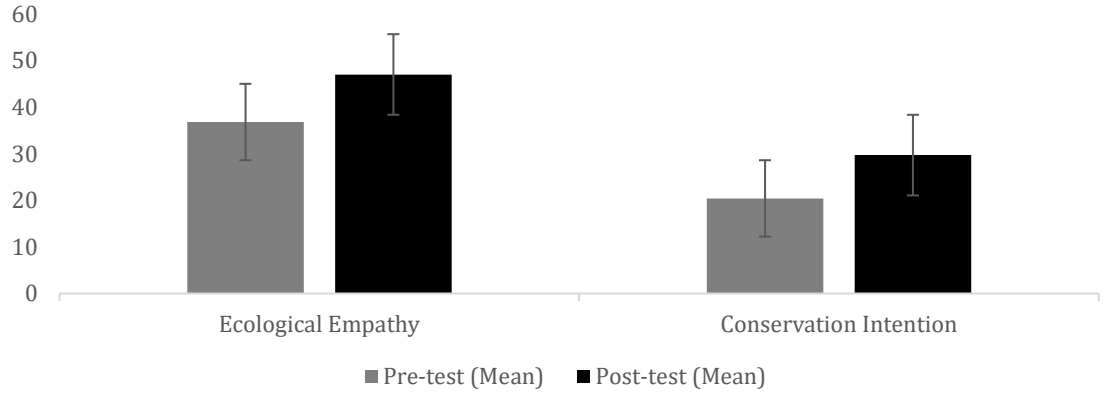

Figure 2 Comparison of the average pre-test and post-test scores on the ecological empathy and conservation intention variables.

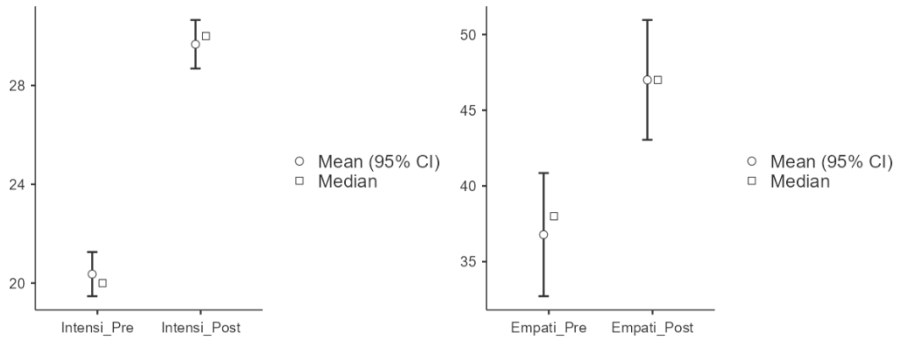

Figure 3 Plot of the mean estimate and 95% confidence interval for the ecological empathy and conservation Intention variables.

The Cohen's d effect size analysis, provided in Table 2, confirms this finding. Ecological empathy has a value of d = 5.7, and conservation intent has a value of d = 15.8. Both variables exceed the "large" category threshold (d > 0.80). The Place-Based Education model is significant and effectively fosters students' empathy and conservation intention for both variables in Figure 3, the average position in the post-test significantly and sharply increased when compared to the pre-test. The most important indicator in this graph is the absence of overlap between the pre-test and post-test confidence interval lines. The separation of these line segments confirms a significant and consistent improvement empathy ability and conservation intention. The analysis of the Place-Based Education approach's impact on student competence used the normalized gain (N-Gain) calculation presented in Table 3. The conservation intention variable was 0.66, and the ecological empathy variable was 0.35; both are categorized as moderate ($0.30 \leq g < 0.70$).

Table 3 Results of the improvement effectiveness test (N-Gain Score)

Variable	Mean pre-test	Mean post-test	Average N-Gain	Category
Ecological empathy	36.8	47.0	0.35	Medium
Conservation intention	20.4	29.7	0.66	Medium

Both variables fall into the same effectiveness category, showing an interesting increasing trend. The N-Gain score for Conservation Intention (0.66) is at the upper limit of the moderate category and near the high category value (0.70). Learning interventions significantly improve students' intention to conserve. The increase in Ecological Empathy (0.35) is relatively moderate. This finding indicates that the PBE model effectively improves both affective domains, with more of an impact on behavioral intentions than on empathy.

Discussions

This study investigates the effectiveness of the Place-Based Education model in improving students' ecological empathy and conservation intentions. Research results indicate that integrating place-based experiential learning significantly impacts the two dependent variables ($p < 0.001$) alongside a large effect size.

The improvement within ecological empathy scores, alongside an effect size of d = 5.7 and a moderate N-Gain of 0.35, indicates that the PBE model improves students' affective sensitivity. In traditional education, empathy typically persists at the cognitive level. Students acknowledge the damage to nature, but their understanding remains superficial. This results from external barriers (Alshehri, 2024), insufficient self-efficacy (Nurkhin et al., 2025), and a small impact of learning on lifestyle changes (Yang et al., 2025). Through the PBE approach, students observe the damage occurring in nature. This process strengthens the emotional dimension of environmental engagement (Gonzalez, 2023; Maharjan et al., 2024).

The results argue for the biophilia hypothesis, which suggests that humans have an inherent inclination to connect with nature (Kellert & Wilson, 1993), requiring activation through direct sensory contact. Direct learning, including observing trash in mangrove areas or interacting with biota, facilitates internalization. This learning experience cannot be replicated through text or images. This study confirms that the environment is not just a learning location but also fosters emotional connections between humans and their surroundings (Jaffe et al., 2025; Teh et al., 2026). The N-Gain difference indicates that empathy is a complex psychological construct. Processes develop more slowly than purely cognitive aspects (Ballarotto & Velotti, 2025).

The conservation intention variable showed a significant rise, with a Cohen's d of 15.8 and an N-Gain of 0.66. This value indicates that PBE effectively converts passive knowledge to a motivation to take action. This high intention can be explained through the Theory of Planned Behavior (Ajzen, 1991), which posits that direct experience about PBE improves attitude toward behavior (Soucy et al., 2025) and perceived behavioral control (Rong et al., 2023). In the context of PBE, students observe environmental

problems and participate in addressing these issues. This promotes self-efficacy, encouraging students to create actions for environmental protection. The activity of planting mangroves in the coastal area of Terakan Island directly involves students in solving existing issues, in addition to analyzing the problems. This will enhance their commitment to pro-environmental efforts because the students are directly engaged in activities such as mangrove planting. Experiential learning is more predictive of pro-environmental intentions than lecture-based learning, as real-world experiences foster a sense of urgency for conservation efforts (Liu et al., 2024; Plechatá et al., 2024).

A comparative examination of N-Gain scores shows the improvement in Conservation Intention (0.66) is significantly greater than that of Ecological Empathy (0.35). This gap highlights the distinct characteristics of the two variables. Ecological empathy is a psychological aspect associated with values and personality, with developments occurring gradually and evolutionarily (Lambert, 2024; P. Smith et al., 2024). Conversely, conservation intentions are action-oriented and more responsive to situational stimuli. In short-term interventions, students discover it is easier to establish intentions than to develop complete empathy (Ballarotto & Velotti, 2025). The two variables improved significantly, showing that PBE performs holistically. Empathy functions as the emotional foundation (Cai et al., 2025; Higuera et al., 2021), while intention represents the conative expression of that emotion (Zhu & Sheng, 2025). The PBE model effectively may help strengthen the relationship between environmental awareness and conservation intention. The two have presented major hurdles for environmental education (Mooney et al., 2022; Räsänen et al., 2024).

D. Conclusion

Research proves that the place-based education (PBE) learning model is a potentially effective pedagogical approach for bridging the gap between environmental knowledge and conservation behavior. The results show that integrating direct experience with nature significantly increases students' ecological empathy and conservation intentions, with a very large effect size. The results consistently improved for both variables, but the magnitude of the improvement (N-Gain) differed between conservation intentions (0.66), which is close to the high category, and ecological empathy (0.35), which is in the moderate category. This phenomenon indicates that place-based interventions are highly responsive in increasing behavioral intentions but require a longer process to reconstruct the depth of empathy. Practically, the research provides empirical evidence for educators to prioritize outdoor learning methods as a solution to address the decline in environmental care character.

E. References

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*(2), 179–211. DOI: https://doi.org/10.1016/0749-5978(91)90020-T

Alshehri, S. Z. (2024). Exploring students' pro-environmental knowledge and behaviour perceptions: A mixed methods investigation. *Journal of Turkish Science Education, 21*(3), 389–409. DOI: https://doi.org/10.36681/tused.2024.021

Alshehri, S. Z. (2024). Exploring students' pro-environmental knowledge and behaviour perceptions: A mixed methods investigation. *Journal of Turkish Science Education, 21*(3), 389–409. DOI: https://doi.org/10.36681/tused.2024.021

Ballarotto, G., & Velotti, P. (2025). Understanding the gap between pro-environmental attitudes and behaviours: A study on the acceptance of negative emotions in workers. *Psyecology, 16*(1), 9–32. DOI: https://doi.org/10.1177/21711976241309837

Bandhu, D., Mohan, M. M., Nittala, N. A. P., Jadhav, P., Bhadauria, A., & Saxena, K. K. (2024). Theories of motivation: A comprehensive analysis of human behavior drivers. *Acta Psychologica, 244*, 104177. DOI: https://doi.org/10.1016/j.actpsy.2024.104177

Cai, S., Hu, Y., He, J., & Li, K. (2025). The impact of embodied cognition on place attachment and supportive behavior toward historic buildings in heritage sites: Exploring the moderating role of resident identity climate. *Frontiers in Psychology, 16*, 1702052. DOI: https://doi.org/10.3389/fpsyg.2025.1702052

Cebrián, G., & Junyent, M. (2015). Competencies in education for sustainable development: Exploring the student teachers' views. *Sustainability, 7*(3), 2768-2786. DOI: https://doi.org/10.3390/su7032768

Cincera, J., Valesova, B., Krepelkova, S., Simonova, P., & Kroufek, R. (2019). Place-based education from three perspectives. *Environmental Education Research, 25*(10), 1510-1523. DOI: https://doi.org/10.1080/13504622.2019.1651826

Darling, M, L., Flook, L., Cook-Harvey, C., Barron, B., & Osher, D. (2020). Implications for educational practice of the science of learning and development. *Applied Developmental Science, 24*(2), 97–140. DOI: https://doi.org/10.1080/10888691.2018.1537791

Gonzalez, F. H. (2023). Exploring the affordances of place-based education for advancing sustainability education: The role of cognitive, socio-emotional and behavioural learning. *Education Sciences, 13*(7), 676. DOI: https://doi.org/10.3390/educsci13070676

Gruenewald, D. A. (2005). Accountability and collaboration: Institutional barriers and strategic

pathways for place-based education. *Ethics, Place & Environment, 8*(3), 261–283. DOI: https://doi.org/10.1080/13668790500348208

Hamilton, E., & Marckini-Polk, L. (2023). The impact of place-based education on middle school students' environmental literacy and stewardship. *Cogent Education, 10*(1), 2163789. DOI: https://doi.org/10.1080/2331186X.2022.2163789

Higuera,T. J. L., Llinares, C., & Macagno, E. (2021). The cognitive-emotional design and study of architectural space: A scoping review of neuroarchitecture and its precursor approaches. *Sensors, 21*(6), 2193. DOI: https://doi.org/10.3390/s21062193

Howley, A., M., Camper, C., & Perko, H. (2011). Place-based education at Island Community School. *The Journal of Environmental Education, 42*(4), 216–236. DOI: https://doi.org/10.1080/00958964.2011.556682

Huang, X., & Lajoie, S. P. (2023). Social emotional interaction in collaborative learning: Why it matters and how can we measure it? *Social Sciences & Humanities Open, 7*(1), 100447. DOI: https://doi.org/10.1016/j.ssaho.2023.100447

Jaffe, M., Kafle, M., Kelly, E. K., & Tam, B. (2025). Finding a pedagogy of empathy in a common read project. *Teaching in Higher Education, 30*(2), 396–411. DOI: https://doi.org/10.1080/13562517.2024.2324727

Kellert, S. R., & Wilson, E. O. (Eds.). (1993). *The biophilia hypothesis*. Island Press.

Lambert, L. M. (2024). Ecological empathy: Relational theory and practice. *Ecosystems and People, 20*(1), 2396919. DOI: https://doi.org/10.1080/26395916.2024.2396919

Liu, J., Yuan, L., Li, M., Li, S. J., Sun, Y., & Yuan, J. (2024). Ecological experiential learning and tourists' pro-environmental behavior intentions: The mediating roles of awe and nature connection. *Heliyon, 10*(1), 23410. DOI: https://doi.org/10.1016/j.heliyon.2023.e23410

Maharjan, B., Pant, B. P., & Dahal, N. (2024). Participatory learning: Exploring place-based pedagogy for future teachers. *Pedagogical Research, 9*(4), 0222. DOI: https://doi.org/10.29333/pr/15155

Mooney, M. E., Middlecamp, C., Martin, J., & Ackerman, S. A. (2022). The demise of the knowledge–action gap in climate change education. *Bulletin of the American Meteorological Society, 103*(10), 2265–2272. DOI: https://doi.org/10.1175/BAMS-D-21-0256.1

Nurkhin, A., Mukhibad, H., Wirawan, A. W., Isnarto, I., Utomo, A. P. Y., Saputro, I. H., & Algifari, A. (2025). The relationship between student environmental education, knowledge, attitude, and behavior. *Journal of Environment and Sustainability Education, 3*(3), 331–339. DOI: https://doi.org/10.62672/joease.v3i3.94

Plechatá, A., Hielkema, M. H., Merkl, L. M., Makransky, G., & Frøst, M. B. (2024). Shifting from information- to experience-based climate change communication increases pro-environmental behavior via efficacy beliefs. *Environmental Communication, 18*(5), 589–609. DOI: https://doi.org/ 10.1080/17524032.2024.2334727

Powers, A. L. (2004). An evaluation of four place-based education programs. *The Journal of Environmental Education, 35*(4), 17–32. DOI: https://doi.org/10.3200/JOEE.35.4.17-32

Räsänen, A., Sarkki, S., Haanpää, O., Isolahti, M., Kekkonen, H., Kikuchi, K., Koukkari, V., Kärkkäinen, K., Miettinen, J., Mäntymaa, E., Nieminen, M., Rahkila, R., Ruohonen, A., Sarkkola, S., Välimäki, M., Yliperttula, K., & Heikkinen, H. I. (2024). Bridging the knowledge-action gap: A framework for co-producing actionable knowledge. *Environmental Science & Policy, 162*, 103929. DOI: https://doi.org/10.1016/j.envsci.2024.103929

Raymond, C. M., Eriksson, M., Korpilo, S., & Carruthers-Jones, J. (2025). The effect of empathy with nature and humans on conservation behaviour. *Journal of Environmental Psychology, 106*, 102710. DOI: https://doi.org/10.1016/j.jenvp.2025.102710

Rong, T., Ristevski, E., & Carroll, M. (2023). Exploring community engagement in place-based approaches in areas of poor health and disadvantage: A scoping review. *Health & Place, 81*, 103026. DOI: https://doi.org/10.1016/j.healthplace.2023.1

Sgouros, R. A., & Stirn, M. A. (2016). Community heritage and place-based learning at the Linn Site, Idaho. *Advances in Archaeological Practice, 4*(4), 479–491. DOI: https://doi.org/10.7183/2326-3768.4.4.479

Shen, C., & Wang, Y. (2023). Concerned or apathetic? Exploring online public opinions on climate change from 2008 to 2019: A comparative study between China and other G20 countries. *Journal of Environmental Management, 332*, 117376. DOI: https://doi.org/10.1016/j.jenvman.2023.117376

Smith, G. A., & Sobel, D. (2010). *Place- and community-based education in schools*. Routledge.

Smith, P., Mann, J., & Marsh, A. (2024). Empathy for wildlife: The importance of the individual. *Ambio, 53*(9). DOI: https://doi.org/10.1007/s13280-024-02017-4

Sobel, D. (2004). *Place-based education: Connecting classrooms and communities*. The Orion Society.

Soga, M., & Gaston, K. J. (2016). Extinction of experience: The loss of human–nature interactions. *Frontiers in Ecology and the Environment, 14*(2), 94–101. DOI: https://doi.org /10.1002/fee.1225

Soucy, A. R., Rahimzadeh-Bajgiran, P., De Urioste-Stone, S., Eitel, K., Jansujwicz, J., & Brownlee, M. (2025). Impact of a place-based educational approach on student and community members' experiences and learning within a post-secondary GIS course. *Journal of Geoscience Education, 73*(4),

386–401. DOI: https://doi.org/10.1080/10899995.2024.237919

Sposab, K., & Rieckmann, M. (2024). Development of sustainability competencies in secondary school education: A scoping literature review. *Sustainability, 16*(23), 10228. DOI: https://doi.org/10.3390/su162310228

Tam, K. P. (2013). Dispositional empathy with nature. *Journal of Environmental Psychology, 35*, 92–104. DOI: https://doi.org/10.1016/j.jenvp.2013.05.0 04

Teh, C., Liu, L. (Lily), & Phang, C. W. (2026). Eliciting pro-environmental behavior with immersive technology: The roles of awe, empathy with nature, and perceived consumer effectiveness. *Information & Management, 63*(1), 104258. DOI: https://doi.org/10.1016/j.im.2025.104258

Ugulu, I. (2013). High school students' environmental attitude: Scale development and validation. *International Journal of Educational Sciences, 5*(4), 415-424. DOI: https://doi.org/10.31901/24566322.2013/05.04.08

Verhoeven, M., Zijlstra, B. J. H., & Volman, M. (2021). Understanding school engagement: The role of contextual continuities and discontinuities in adolescents' learner identities. *Learning, Culture and Social Interaction, 28*, 100460. DOI: https://doi.org/10.1016/j.lcsi.2020.100460

Yang, X., Chen, S., Liu, T., Luo, J., & Tang, Y. (2025). Practice primacy: Revisiting the knowledge–action gap in pro-environmental behavior with explainable AI. *Sustainability, 17*(21), 9916. DOI: https://doi.org/10.3390/su17219916

Yemini, M., Engel, L., & Ben Simon, A. (2025). Place-based education: A systematic review of literature. *Educational Review, 77*(2), 640–660. DOI: https://doi.org/10.1080/00131911.2023.2177260

Zhu, Z., & Sheng, D. (2025). Toward cognition, affect, and conation: The design and use of neuroscience in information behavior studies. *Journal of the Association for Information Science and Technology, 76*(1). DOI: https://doi.org/10.1002/asi.70007