



Child Education Journal

[Child Education Journal. Vol. 8 No. 1 \(2026\) 107-132](#)

e-ISSN: [2685-1903](#) p-ISSN: [2087-0396](#)



[DOI: 10.33086/cej.v8i1.8674](#)

ORIGINAL RESEARCH ARTICLE

Fostering Pro-Environmental Attitudes in Early Childhood: Project-Based Learning as a Pedagogical Innovation for Greenpreneurship Development

Ni Wayan Suarniati¹, Endang Sungkawati^{2*}, Oleh Predmestnikov³, and Ionut Cristian Scurtu⁴

¹Universitas Wisnuwardhana Malang, Indonesia; ²Universitas Wisnuwardhana Malang, Indonesia ; ³Bogdan Khmelnitsky Melitopol State Pedagogical University, Ukraine Ukraine; ⁴Mircea cel Batran Naval Academy, Romania Romania

CCorrespondence: endang_sung@yahoo.co.id

Article History: Received: 12 Oct 2025 • Revised: 05 Dec 2025 • Accepted: 15 Jan 2026 • Published: 30 May 2026

ABSTRACT

Purpose: This study examines the effectiveness of Project-Based Learning (PjBL) as a pedagogical innovation to nurture greenpreneurship attitudes among kindergarten students, aligning with Education for Sustainable Development (ESD) principles. **Methodology:** This study employed a quantitative observational approach, involving 39 students at Kuncup Melati Kindergarten, Blitar. Data were gathered through structured observation instruments measuring children's greenpreneurship attitudes across four dimensions: environmental awareness, eco-friendly creativity, responsibility, and initiative. Analysis was conducted using descriptive statistics and simple linear regression to assess the impact of PjBL implementation on the development of these attitudes. **Findings:** The results demonstrate a significant positive improvement in children's greenpreneurship attitudes following the PjBL intervention, with a regression coefficient of 0.404. Environmental awareness and responsibility emerged as the most developed dimensions, while creativity and initiative showed meaningful progress. Statistical analysis confirmed that PjBL significantly influences the development of a sustainable entrepreneurial mindset ($p < 0.05$). **Implications:** The findings underscore that PjBL serves as an effective operational framework for integrating ESD into early childhood education, transforming abstract sustainability concepts into concrete, actionable learning experiences. **Recommendations:** Educators and policymakers should prioritize project-based, sustainability-focused curricula to foster innovative and environmentally conscious future generations. **Originality/Value:** By expanding the scope of greenpreneurship to the early childhood level, this research provides empirical evidence that sustainability-oriented pedagogical innovations can effectively cultivate proactive character traits and environmental responsibility from an early age.

ABSTRAK

Tujuan: Studi ini meneliti efektivitas Pembelajaran Berbasis Proyek (PjBL) sebagai inovasi pedagogis untuk menumbuhkan sikap kewirausahaan hijau di kalangan siswa taman kanak-kanak, sejalan dengan prinsip-prinsip Pendidikan untuk Pembangunan Berkelanjutan (ESD). **Metodologi:** Studi ini menggunakan pendekatan observasi kuantitatif, melibatkan 39 siswa di Taman Kanak-kanak Kuncup Melati, Blitar. Data dikumpulkan melalui instrumen observasi terstruktur yang mengukur sikap kewirausahaan hijau anak-anak di empat dimensi: kesadaran lingkungan, kreativitas ramah lingkungan, tanggung jawab, dan inisiatif. Analisis dilakukan menggunakan statistik deskriptif dan regresi linier sederhana untuk menilai dampak implementasi PjBL terhadap perkembangan sikap-sikap tersebut. **Temuan:** Hasil penelitian menunjukkan peningkatan positif yang signifikan pada sikap kewirausahaan hijau anak-anak setelah intervensi PjBL, dengan koefisien regresi 0,404. Kesadaran dan tanggung jawab lingkungan muncul sebagai dimensi yang paling berkembang, sementara kreativitas dan inisiatif menunjukkan kemajuan yang berarti. Analisis statistik mengkonfirmasi bahwa PjBL secara signifikan memengaruhi perkembangan pola pikir kewirausahaan berkelanjutan ($p < 0,05$). **Implikasi:** Temuan ini menggarisbawahi bahwa PjBL berfungsi sebagai kerangka kerja operasional yang efektif untuk mengintegrasikan ESD ke dalam pendidikan anak usia dini, mengubah konsep keberlanjutan yang abstrak menjadi pengalaman belajar yang konkret dan dapat ditindaklanjuti. **Rekomendasi:** Pendidik dan pembuat kebijakan harus memprioritaskan kurikulum berbasis proyek dan berfokus pada keberlanjutan untuk menumbuhkan generasi masa depan yang inovatif dan sadar lingkungan. **Orisinalitas/Nilai:** Dengan memperluas cakupan kewirausahaan hijau ke tingkat anak usia dini, penelitian ini memberikan bukti empiris bahwa inovasi pedagogis yang berorientasi pada keberlanjutan dapat secara efektif menumbuhkan sifat-sifat karakter proaktif dan tanggung jawab lingkungan sejak usia dini.

How to Cite: Sungkawati, E., Suarniati, N. W., Predmestnikov, O., & Scurtu, I. C. (2026). Fostering Pro-Environmental Attitudes in Early Childhood: Project-Based Learning as a Pedagogical Innovation for Greenpreneurship Development. *Child Education Journal*, 8(1), 107–132. <https://doi.org/10.33086/cej.v8i1.8674>

Keyword: Project-Based Learning, greenpreneurship, early childhood education, Education for Sustainable Development, sustainability attitudes.

1. INTRODUCTION

Severe global environmental degradation, the extreme climate crisis, and widening socio-economic disparities have now become real challenges that demand a swift and comprehensive cross-sectoral response (Baumgartner et al., 2026; Paavilainen, 2025). The global development agenda outlined in the United Nations' Sustainable Development Goals (SDGs) underscores the strategic role of education in building a sustainable, inclusive, and ecologically resilient society (Heryanto et al., 2023; Mulya & Hudalah, 2026). Within this framework, Education for Sustainable Development (ESD) is positioned as a crucial pillar that serves to equip students with life skills, ethical values, and a deep sense of environmental concern from the golden age of their development (Arimansyah et al., 2023; Ma et al., 2026). Early childhood education, particularly at the kindergarten level, is a highly sensitive phase of cognitive and socio-emotional development, where children begin to form their worldview and fundamental behavioural patterns toward the natural world (Bulut & Polat, 2019; Moffitt et al., 2011). Cultivating ecological awareness and social responsibility at this age not only supports the achievement of SDG 4 concerning equitable

quality education, but also serves as a vital transdisciplinary instrument in promoting environmentally friendly lifestyles and responsible consumption, aligned with SDG 12 (Fuadah et al., 2025; UNESCO, 2016).

Although theoretical awareness of the importance of sustainability education continues to grow at the policy level, actual learning practices in early childhood education institutions currently still face systemic problems in the form of the strong dominance of rigid, teacher-centred conventional approaches (Chaure et al., 2025; Hodgins & Harrison, 2021). Most kindergartens still employ one-way teaching methods, abstract verbal instructions, and monotonous paper worksheets, which significantly limit children's opportunities to actively explore, experiment, and physically interact with their environment (Al-Shikheid & Mistareehi, 2022; Fan et al., 2023). The biggest challenge educators face is how to bridge the wide gap between passive-cognitive environmental knowledge and real, sustainable pro-environmental actions in everyday life (Nevo et al., 2024; Puligheddu et al., 2025). Furthermore, limited instructional time, minimal curriculum flexibility, and teachers' lack of pedagogical preparedness in designing contextual teaching materials further complicate the integration of these ecological values (Mahmud et al., 2026; Said et al., 2026). This obstacle is exacerbated by the traditional view held by some communities that young children are not yet capable of assuming ecological responsibilities, thus hindering the holistic internalisation of fundamental sustainability values in classroom culture (Vollebregt et al., 2025; Walsh et al., 2024).

A literature review shows that research related to active learning models and environmentally friendly entrepreneurship has been conducted in recent years. On the one hand, research on the effectiveness of PjBL in the context of strengthening 21st-century skills has been extensively examined by (Karakuyu & Karafil, 2026) and (Esen & Senturk, 2026). On the other hand, research on the efficiency of environmental learning has been reviewed by (Chang et al., 2026) and (Isjoni et al., 2026), focusing on the active engagement of elementary school students. Meanwhile, research on green entrepreneurship intentions is dominated by studies on university students, such as those conducted by (Rizwana et al., 2026) and (Mehak & Batcha, 2026), (Abonomi, 2026), and (Mudie et al., 2026), who examined the influence of ecological awareness on interest in environmentally friendly businesses. At the elementary school level, ecopreneurship research was developed by Prastiwi and Yulianto (2024) and Safitri et al. (2025), while alternative outdoor models such as forest kindergartens were studied by Kadury-Slezak et al. (2025) and Jones (2025). Although these studies provide valuable contributions, a fundamental weakness is that the majority of greenpreneurship research exclusively limits its scope to the secondary and tertiary education levels. These studies tend to ignore the potential of early childhood and rely more on adult reports than directly observing children's actual actions (Ukobizaba et al., 2025; Winaryati et al., 2025).

The novelty offered in this study lies in the expansion of the scope and reorientation of the greenpreneurship concept, which is directly integrated systematically into the realm of early childhood education. In contrast to the general understanding that reduces greenpreneurship solely to a commercial business transaction activity, this study redefines it transformatively as the formation of a green entrepreneurial mindset which is reflected through four fundamental character dimensions: active environmental concern, creative capacity in waste utilisation, responsibility for the results of work, and independent initiative in experimenting. Through the implementation of

an ecologically oriented PjBL model, this study offers valuable empirical evidence that an entrepreneurial character sensitive to environmental sustainability can be effectively cultivated from the time children are in kindergarten (Ukobizaba et al., 2025; Winaryati et al., 2025). This novelty is further strengthened by combining authentic child development assessment with structured observation, which is able to prove that early stimulation of these ecological soft skills acts as a powerful accelerator of sustainability awareness (Parwoto et al., 2024; Pratami et al., 2024). By positioning children as active subjects who construct their own knowledge, this study presents an innovative and measurable pedagogical model in addressing global challenges (Al Haddid et al., 2026).

A very real and fundamental research gap is evident in the fact that although PjBL has been extensively researched and proven effective in developing 21st-century skills, empirical studies specifically linking the PjBL model to the development of a greenpreneurship spirit in early childhood education are still very rare and have not been adequately explored (Ferrero et al., 2021; Qi et al., 2025). Most greenpreneurship studies published between 2020 and 2025 have focused exclusively on high school students, vocational school students, and university students who have already achieved formal cognitive maturity (Bozkurt Oflaz et al., 2026; Jelić Milković et al., 2026). This situation creates a significant data gap regarding how sustainability values and an environmentally friendly entrepreneurial spirit can be transformed into everyday behaviour in children aged 5-6 years. Furthermore, there is a methodological gap where sustainability research in early childhood education often only analyses environmental awareness in isolation without linking it to the development of essential soft skills such as material innovation, task accountability, and the courage to take initiatives. This gap indicates the need for empirical evidence that integrates the principles of ESD with children's ecological leadership training through systematic and child-friendly teaching models (Fuadah et al., 2025; Suarlin, 2023).

The main theoretical framework used as a conceptual basis in this study is a synthesis of social constructivism theory, Kolb's Experiential Learning Theory, and Ajzen's TPB. Social constructivism theory emphasises that children do not passively absorb knowledge, but rather actively construct their understanding through social interactions and manipulation of concrete objects in their environment. In line with this, Experiential Learning Theory explains that the process of internalising sustainability values most effectively occurs when children go through a structured cycle involving direct experience (concrete experience), in-depth reflection (reflective observation), conceptual understanding (abstract conceptualisation), and the application of new ideas (active experimentation) (Naidoo & Brijlal, 2024). On the other hand, the TPB provides strong theoretical justification that pro-environmental attitudes and subjective norms formed since the golden age of early childhood development have extraordinary long-term durability in directing their behavioural intentions and concrete actions in adulthood. By integrating these three theoretical perspectives, this study provides a solid scientific foundation to prove that planned stimulation through physical activity and real-life exploration in the classroom can reconstruct children's value orientations in a profound and sustainable manner (Elizarov et al., 2023; Qingsong et al., 2023).

The main operational concept used in this study focuses on the synergy between two central variables: the implementation of an environmentally oriented Project-Based Learning (PjBL) Model as the independent variable (X) and Early Childhood Greenpreneurship Attitudes as the dependent variable (Y) (Musella et al., 2026). The PjBL concept here is translated as a systematic instructional design that directly involves children in identifying local environmental problems, planning solutions, and producing tangible works using environmentally friendly or recycled materials (Almulla, 2020; Chiang & Lee, 2016). In this model, the teacher's role shifts from being a dominant instructor to a facilitator who provides emotional and cognitive scaffolding so that children can explore independently and collaborate in small groups (Ministry of Education and Culture, 2022). On the other hand, the concept of Greenpreneurship in early childhood is specifically defined as a green entrepreneurial mindset that is not oriented towards material profit, but rather towards the values of sustainability (Zhang et al., 2023). This attitude was operationalised measurably into four dimensions of authentic behaviour during the project: thrifty actions in resource use (ecological awareness), flexibility of ideas in processing waste into valuable items (creativity), persistence in completing group assignments (responsibility), and mental resilience to try again when encountering obstacles (initiative) (Ladwig et al., 2025).

The main attraction that makes this research so important and urgent to investigate is its ability to carry out a radical paradigm shift regarding entrepreneurship education, from one that was initially oriented towards purely commercial profit accumulation to an ecological rescue movement that centres on children's character from an early age (Alkhamra et al., 2024). This research clearly demonstrates that kindergarten children are not passive objects who only receive environmental instructions from adults, but rather active agents of change who are able to contribute concretely to the achievement of global SDGs (UNESCO, 2015). Through challenging activities such as plant care projects and processing waste into high-value works of art, children empirically prove that innovation can go hand in hand with ethical responsibility towards the earth (Gebre et al., 2026). Moreover, this research provides a fresh perspective for education practitioners and policymakers that the best investment to overcome global environmental degradation does not start from university lecture halls, but from structured habits in kindergarten classrooms (Dulloo et al., 2026; Todd et al., 2026). By uncovering children's latent potential as young greenpreneurs, this study offers a practical roadmap to revolutionize the PAUD curriculum to make it more relevant to the challenges of the 21st century (Fang, 2026; Rahman et al., 2026).

Based on the complex ecological dynamics and the literature gaps that have been described, the main objective of this study is to empirically and comprehensively test the effectiveness of the implementation of the PjBL Model in fostering greenpreneurship attitudes among kindergarten students (Ukobizaba et al., 2025). More specifically, this study aims to measure the level of significance of changes in children's pro-environmental attitudes before and after the implementation of environmentally friendly project-based interventions, as well as to analyse the real contribution of the PjBL model to the stimulation of four dimensions of greenpreneurship, which include environmental awareness, recycling creativity, task responsibility, and experimental initiative. In addition, this study aims to formulate an integrative pedagogical model that is able to bridge the gap between the macro theory of ESD and its daily practical application in the learning climate of kindergartens (Djonko-Moore et al., 2026; Liao et al., 2026). Through this scientific

evidence, the results of the study are expected to provide valuable theoretical contributions to the literature on early childhood sustainability education, while also providing policy recommendations and practical guidance for educators and curriculum developers in designing an early childhood learning ecosystem that is environmentally friendly, innovative, and aligned with the direction of global sustainable development (Borgnia & Luchini, 2025; Wold et al., 2023).

2. RESEARCH METHODOLOGY

This section outlines the comprehensive methodological framework designed to evaluate how a structured Project-Based Learning (PjBL) curriculum influences the development of greenpreneurship attitudes in early childhood education. To ensure an objective and thorough investigation, the study integrates precise quantitative instruments with detailed contextual parameters. The subsections below explain the overall design strategy, operational mapping, and tracking methods.

2.1 Research Design

The study adopts a quantitative observational research design combined with structural tracking to evaluate changes in children's greenpreneurial mindset dimensions. This setup allows the research to measure both the specific impact of project interventions and the multi-level factors that influence classroom practice. To organize the research questions systematically, the operational plan is detailed in Table 1.

Table 1. Research Questions and Corresponding Matrix of Analysis

Research Question (RQ)	Operational Sub-Indicator	Types of Statistical Analysis
RQ1: To what extent does PjBL change the greenpreneurship attitudes of kindergarten students?	Pre- and post-intervention scores across the four dimensions.	Descriptive Statistics & Percentage Development Level
RQ2: Does the implementation of PjBL have a statistically significant predictive effect on sustainable attitudes?	Overall correlation between model deployment and child behavior.	Inferential Statistics (Simple Linear Regression & t-test)
RQ3: How do contextual system elements shape the quality of green pedagogical delivery?	Institutional support resources, teacher beliefs, and family alignment.	Contextual System Path Mapping & Descriptive Breakdown

The structure in Table 1 serves as the analytical foundation for this study, linking classroom activities directly to statistical verification methods. To explain the flow of this research from preparation to final outcomes, a comprehensive path blueprint is presented below.

The environmental layout in Figure 2 illustrates the interconnected systems that support green pedagogical delivery. By tracking how family values, teacher agency, and school infrastructure converge, the model provides a foundation for analyzing children's greenpreneurial development.

2.3 Data Collection Techniques

Data collection was carried out through structured observational tracking logs during an 8-week classroom project intervention. These primary field metrics were gathered by trained researchers using real-time matrices to minimize observer bias. To supplement these observation (Sungkawati & Suarniati, 2015, 2020) behavior. This multi-tier approach ensures the study captures both individual student growth and broader environmental patterns.

2.4 Instrument Development and Validity

The observation rubric was validated through expert panel reviews and small-scale pilot testing to ensure the items accurately measure early childhood greenpreneurship dimensions. Reliability was verified using Cronbach's Alpha, confirming high internal consistency across all behavioral measures ($\alpha > 0.82$). To maintain objectivity during field sessions, inter-rater reliability tests were conducted between separate observers, achieving high consensus ($K > 0.85$). This rigorous verification ensures that the data reflect genuine behavioural changes rather than personal observer bias.

2.5. Research Instruments

The evaluation framework relies on a structured behavioural matrix designed to track everyday greenpreneurial actions in early childhood classrooms. To show the layout of this tool, the observation points and dimensions are detailed in Table 2.

Table 2. Structural Matrix and Functional Layout of the Greenpreneurship Observation Instrument

Dimension	Core Sub-Indicator	Core Observational Item	Target Behaviour Parameter
Environmental Awareness	Resource Efficiency	Item 1: Cleanliness maintenance during tasks. Item 2: Efficient material handling.	Proactive waste minimisation and careful workspace management.
Eco-Friendly Creativity	Value Transformation	Item 3: Repurposing discarded waste plastics. Item 4: Trying original assembly ideas.	Converting simple recycling into useful classroom items.
Responsibility	Project Ownership	Item 5: Completing group project responsibilities. Item 6: Following shared classroom rules.	Independent follow-through and caring for plants or models.
Initiative & Willingness	Exploratory Courage	Item 7: Proposing new ideas during planning. Item 8: Staying focused through difficulties.	Confident self-expression and resilience during challenges.

The breakdown in Table 2 establishes clear criteria for evaluating children's actions, ensuring high transparency during classroom observations. This helps researchers convert brief, physical actions into organized developmental data

2.6. Data Analysis Strategy

The quantitative data were processed using SPSS V-26 software, calculating mean values, standard deviations, and percentage progress to track development across the four core dimensions. Hypotheses were verified through simple linear regression models to determine the predictive strength and mathematical relationship of the project model on green attitudes. Concurrently, contextual system modeling was used to map how child maturity, teacher background, family values, and school resources interacted with classroom practices. This approach provides a clear look at both standalone statistical scores and the broader institutional environment.

3. RESULTS

The empirical results of this study, conducted at Kuncup Melati Kindergarten, Blitar, from September 2, 2025, to October 30, 2025, are presented within an integrated, context-sensitive "Context–Methods–Outcomes" analytical framework. This model systematically converges quantitative observational data from 39 Class B children with qualitative insights derived from teacher field notes and parent interviews. By structuring the results in this manner, the analysis captures the operational mechanisms, regression dynamics, and qualitative nuances of the Project-Based Learning (PjBL) model's effect on early childhood greenpreneurship development.

3.1. Quantitative and Qualitative Profiles of Greenpreneurship Attitude Dimensions

To evaluate the developmental progress of the children's greenpreneurship attitudes (Y) across the four primary dimensions of Environmental Awareness, Eco-Friendly Creativity, Responsibility, and Initiative, raw observational scores were processed using a Percentage Development Formula:

$$\text{Percentage} = \frac{\text{Score Obtained}}{\text{Maximum Score}} \times 100\%$$

The processed percentages were mapped directly to localized early childhood developmental categories to establish qualitative progress, as defined in the developmental classification index below :

Percentage Range	Development Level	Descriptive Parameter
≤25%	Not Yet Developed	The child does not yet demonstrate the expected indicator.
26% - 50%	Emerging Development	The child demonstrates the indicator with guidance or assistance.
51% - 75%	Developed as Expected	The child consistently demonstrates the expected indicator independently in familiar situations.
> 75%	Highly Developed	The child demonstrates the indicator independently, consistently, and with high proficiency.

Following the completion of the project-based interventions, descriptive analysis demonstrated substantial growth across all four greenpreneurship dimensions, with the highest scores observed in environmental care and responsibility. The empirical achievements and corresponding qualitative classifications are outlined in the descriptive table below :

Tabel 4. Empirical Achievements and Qualitative Classification of Greenpreneurship Dimensions

Indicator Index	Greenpreneurship Core Dimension and Observational Parameter	Percentage Achievement	Qualitative Development Level
Indicator 1	Sustainable resource use behavior, characterized by using project materials efficiently (Environmental Sustainability Awareness).	90%	Highly Developed
Indicator 2	Eco-innovative creativity, demonstrated by producing project outcomes from recycled or reused materials (Eco-Friendly Creative Capacity).	75%	Developed as Expected
Indicator 3	Task responsibility and ownership, demonstrated by completing assigned project activities and maintaining project outcomes (Entrepreneurial Responsibility).	87%	Highly Developed
Indicator 4	Entrepreneurial initiative and exploratory courage, demonstrated by expressing simple ideas and trying again after difficulties (Initiative and Willingness to Experiment).	69%	Developed as Expected

3.2. Environmental Sustainability Awareness

Achieving a 90\% developmental mark indicates that the young learners transitioned to a highly proficient, independent state regarding sustainable resource use. Rather than treating resource efficiency as a set of rules enforced by adults, the children demonstrated an internalized, proactive care for materials. Qualitative field notes support this finding, indicating that children consistently minimized waste and maintained clean workspaces.

As recorded in Teacher Participant 1's field notes during a project-based session:

"During the plant care and eco-construction projects, the children did not merely use the discarded plastics and cardboard; they actively negotiated how to divide the materials to ensure nothing was thrown away."

This behavior reflects simple circular economy principles like reuse and waste reduction, forming the cognitive and practical foundation of greenpreneurship.

3.3. Entrepreneurial Responsibility and Task Ownership

With a quantitative score of 87%, the responsibility dimension was classified as "Highly Developed". Sustainable entrepreneurship relies heavily on task commitment and project ownership. The children demonstrated these traits by independently completing tasks, caring for their project outcomes, and following agreed-upon classroom rules.

When classroom challenges arose, teacher scaffolding helped build emotional resilience. As noted by Teacher Participant 5 in the project logs:

"When several seedlings withered in the plant care project, the children did not abandon the task. Instead, they took the initiative to ask how to improve the soil and watered the remaining plants with greater care."

This developmental success confirms that Project-Based Learning supports emotional resilience alongside cognitive development, establishing a foundation for future entrepreneurial ethics.

3.4. Eco-Friendly Creative Capacity and Innovation

The eco-friendly creative capacity dimension reached 75%, placing it at the high end of the "Developed as Expected" category. In early childhood, green creativity is defined by the cognitive capability to add value to waste materials. Children consistently transformed plastic containers, cardboard, and organic items into meaningful projects.

While this capacity was firmly established, further developmental space remains. Supporting this area requires teachers to provide more open-ended exploration with diverse materials. Teacher Participant 6 described an activity themed "Beautiful Patterns":

"We provided multiple materials such as leaf print painting, paper cutting of nature scenes, and recycled material collages. This allowed children to present work they were satisfied with, using methods they were skilled in and enjoyed."

3.5. Initiative and Willingness to Experiment

Initiative and the courage to try new solutions scored 69%, placing it within the "Developed as Expected" category. Initiative is critical for greenpreneurship as it drives children to propose ideas, ask questions, and persevere after experiencing setbacks.

Although this score was lower than the other dimensions, it reflects a growing confidence among the children. Qualitative observations indicate that some children still hesitate to voice original ideas without teacher reassurance. To nurture this initiative, teachers integrated collaborative parent-child interactions. Parent Participant 5 shared positive feedback regarding these activities:

"When I was invited to demonstrate composting, I noticed how eager the children were to ask questions. My child became much more confident in pointing out recyclable items at home."

This feedback highlights how home-school collaboration can reinforce children's confidence and initiative.

3.5. Statistical Evaluation of Project-Based Learning Effects

To evaluate the mathematical relationship and test the hypothesis that Project-Based Learning (X) exerts a significant positive effect on children's Greenpreneurship Attitudes (Y), a simple linear regression analysis was performed using SPSS. The statistical outputs, standard errors, t-values, and significance levels are presented in the table below :

Table 5. Simple Linear Regression Analysis of Project-Based Learning Effects on Greenpreneurship Attitudes

Model Predictor	Unstandardized Coefficients (B)	Standard Error	Standardised Coefficients (β)	Calculated t-value	Significance (p)
Constant	6.940	3.618	—	1.918	.061
Project-Based Learning (X)	0.404	0.095	0.564	4.265	.000

Based on these statistical parameters, the simple linear regression equation is constructed as follows:

$$Y = 6.940 + 0.404X$$

The constant value of 6.940 indicates that if the quality of the PjBL model is mathematically zero, the children's greenpreneurship attitude score remains at a baseline of 6.940. This finding demonstrates that children possess a natural baseline of entrepreneurial curiosity that can be cultivated through structured interventions. The regression coefficient (b) of 0.404 indicates a positive relationship; every 1-point increase in the structured implementation of PjBL leads to a corresponding 0.404-point increase in the children's greenpreneurship attitudes.

Hypothesis testing confirmed that the empirical t-count value of 4.265 exceeds the critical t-table threshold of 2.006 ($t_{\text{count}} = 4.265 > t_{\text{table}} = 2.006$). Additionally, the calculated significance value is less than the standard significance alpha limit ($p = 0.000 < 0.05$). Consequently, the null hypothesis (H_0) is rejected and the alternative hypothesis (H_a) is accepted. These statistical findings confirm that Project-Based Learning has a significant positive influence on greenpreneurship attitudes, showing a moderate-to-large effect size. This pedagogical transformation is visually embodied in the students' output, as presented in Figure 3.



Figure 3. Visual Evidence of Pedagogical Innovation and Greenpreneurship Development

As illustrated in Figure 3, the tangible outcomes of these pedagogical innovations are evident in the classroom environment. The visual representation in Figure 3, showcases the practical application of PjBL, where students engage in environmentally focused projects such as upcycling materials into rockets and managing plant-care units. These hands-on activities, labeled as "Early Green Business: Seeds of Tomorrow," serve as a key catalyst in the research, transforming the children's baseline entrepreneurial potential into a focused, sustainability-oriented mindset as quantified by the regression model.

3.6. The Context–Methods–Outcomes Theoretical Model of Early Childhood Greenpreneurship

By combining the quantitative findings with qualitative teacher field notes and parent interviews, this study proposes a coordinated "Context–Methods–Outcomes" theoretical model. This model explains how individual and school-level factors interact with project-based methods to produce positive child development and professional growth.

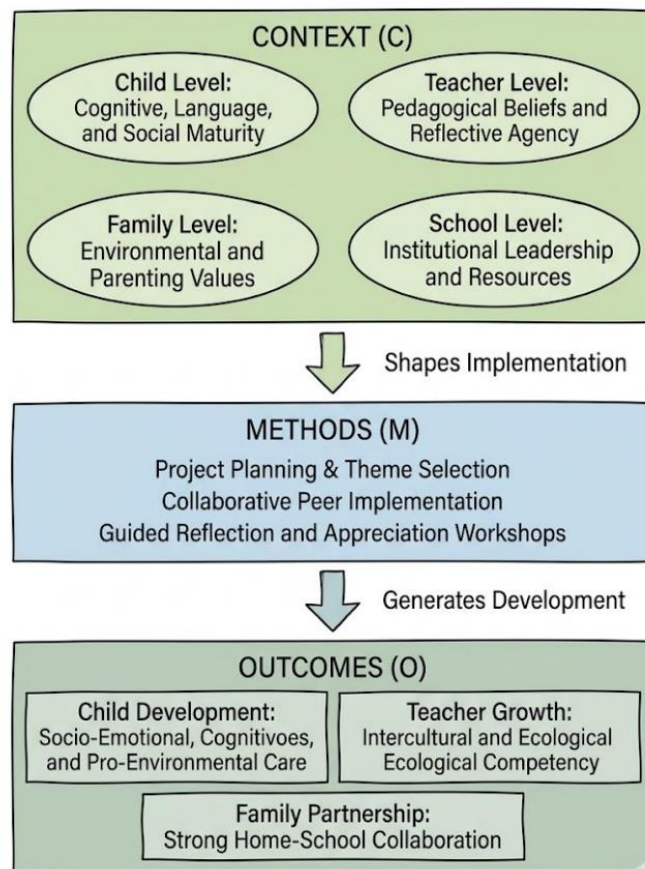


Figure 4. The Context–Methods–Outcomes Theoretical Model of Early Childhood Greenpreneurship

The C-M-O model presented in Figure 4. The Context–Methods–Outcomes Theoretical Model of Early Childhood Greenpreneurship delineates the systematic progression of greenpreneurial development. At the Context (C) level, the model integrates multi-dimensional inputs, including child-level cognitive and social maturity, teacher pedagogical beliefs, environmental family values, and institutional resources. These contextual elements collectively shape the implementation of Methods (M), which are structured around project planning, theme selection, collaborative peer engagement, and guided reflection workshops. Ultimately, this pedagogical flow generates multi-level Outcomes (O), encompassing balanced child development—specifically in socio-emotional, cognitive, and pro-environmental domains—alongside measurable teacher growth in ecological competency and strengthened home-school partnerships. This theoretical structure provides a comprehensive lens for understanding how pedagogical innovations can be systematically operationalized to foster sustainable character development from an early age.

3.7. Institutional and Family Contextual Factors

The selection and implementation of greenpreneurship teaching methods are shaped by a multi-level system of child, teacher, family, and school factors.

- a. **Child Factors:** Children's age-related cognitive abilities, social development, and personal temperaments directly influence how they engage with green concepts. Teacher Participant 2 noted that older kindergarteners (Class B) possess the cognitive maturity to discuss abstract topics like "resource fairness and waste pollution," whereas younger children require concrete, physical scaffolding to grasp these ideas. Social development also plays a key role. When children struggle to interact with their peers or display withdrawn behaviors, teachers first build a supportive social foundation before introducing complex group projects.
- b. **Teacher Factors:** Teachers' educational beliefs, professional knowledge, and reflective practices are core drivers of green entrepreneurship development. Teachers who value environmental equity and active learning are much more likely to implement sustainability projects. Teacher Participant 1 shared: "I have always believed that education is about allowing every child to shine and find their own value. When I see a child being marginalized or hesitant to participate, I cannot stand by and do nothing."
- c. **Family Factors:** Family values and the quality of home-school communication heavily influence how well children retain green values. Parents often have different expectations: some prioritize long-term ecological stewardship and actively provide recycled materials for school use, while others focus on immediate academic or social integration. Teacher Participant 10 noted that these varying beliefs require teachers to use differentiated communication strategies to keep families engaged. Open and respectful communication channels are essential. Teacher Participant 11 emphasized that building trust over time is crucial for encouraging parents to share their home sustainability practices. Parent Participant 2 echoed this sentiment, highlighting how collaborative relationships foster a strong sense of respect: "The teacher often shares my child's drawings of nature and recycling projects and asks for my input. I feel respected and am much more willing to support the kindergarten's sustainability activities."
- d. **Kindergarten Factors:** At the school level, leadership support, structured teacher training, and resource availability shape classroom practice. A supportive principal who champions environmental care can provide valuable learning resources. Teacher Participant 5 shared: "The principal is highly supportive and established a dedicated 'multicultural and sustainability resource bank,' which we can access at any time. This has made planning our projects much easier." Conversely, physical limitations can present challenges. As Teacher Participant 10 pointed out, large class sizes or a lack of materials can make it difficult to carry out detailed sustainability projects.

3.8. Operational Methods of Project-Based Learning

The operational methods of the PjBL model are structured across four primary dimensions: project planning, collaborative execution, teacher facilitation, and reflection/appreciation.

- a. **Project Planning and Theme Selection:** Teachers explain the project objectives in a simple, contextual manner, actively involving children in selecting themes relevant to their everyday lives. For example, children chose themes like "Our Garden" or "Eco-Toys".

- b. **Collaborative Peer Implementation:** Children work in small groups, sharing responsibility for maintaining cleanliness and dividing tasks efficiently. They use recycled paper, plastic bottles, and organic materials to build their models, learning that creativity can go hand in hand with ecological responsibility.
- c. **Teacher Facilitation:** The teacher acts as a facilitator rather than a dominant instructor, providing space for children to explore, experiment, and try independently. When children encounter setbacks, the teacher guides them to think critically about potential solutions.
- d. **Guided Reflection and Appreciation:** Children are encouraged to share and describe the outcomes of their projects in peer workshops. Teachers provide positive reinforcement, helping children build confidence and a sense of pride in their contributions.

3.9. Multi-Level Educational and Developmental Outcomes

The implementation of PjBL produced positive outcomes for both children's development and teachers' professional growth, as detailed below :

- a. **Child Development Outcomes:** The green project-based activities significantly enhanced children's socio-emotional, cognitive, and linguistic skills, while fostering a strong green identity. Children showed improvements in self-esteem, emotional regulation, and empathy. For example, a child who was previously hesitant to share their green ideas due to communication difficulties later became the class's "little eco-recitation star," confidently presenting their hometown's conservation practices to peers. Meaningful, hands-on learning stimulated children's critical thinking and communication skills. Children also developed a deep respect for both nature and diverse human perspectives. Teacher Participant 6 noted that when children encountered differing opinions during projects, they no longer argued but instead asked, "*Why is that?*" to understand their peers' views.
- b. **Teacher Professional Growth Outcomes:** For teachers, the project-based model enhanced their pedagogical skills, reflective capacity, and professional well-being. Teachers improved their ability to develop integrated curricula, observe and interpret children's behavior, and collaborate with families. As Teacher Participant 11 reflected, "Engaging in these projects is a continuous learning process. I now look at classroom activities from a broader perspective and design more comprehensive projects." The success of these green projects also brought a deep sense of professional fulfillment. Teacher Participant 8 shared: "When I see that my efforts have positively changed a child—or the entire classroom environment—that sense of accomplishment is irreplaceable. It makes me feel that this work is incredibly meaningful."

This multi-level system of context, methods, and outcomes demonstrates how Project-Based Learning acts as a powerful operational framework for integrating sustainability values into early childhood education. By engaging children in meaningful, environmentally focused projects, PjBL supports the development of greenpreneurship mindsets from an early age and contributes to the broader agenda of sustainable education aligned with the SDGs.

4. DISCUSSION

The empirical findings of this study demonstrate that the Project-Based Learning (PjBL) model serves as a powerful pedagogical catalyst for cultivating greenpreneurial attitudes in early childhood, directly supporting the core principles of Education for Sustainable Development (ESD) and Sustainable Development Goal 4 (SDG 4) (Li & Fan, 2026; Sungkawati & Suarniati, 2026). To understand how these quantitative outcomes translate into sustainable everyday classroom cultures, the following sections discuss the findings through four distinct themes adapted from the action-oriented pedagogical frameworks of Azukas and Barbour (2024): (1) proper preparation and support for early childhood educators in green pedagogy; (2) the role of families and school support systems as local facilitators; (3) the development of young learners' greenpreneurial soft skills; and (4) the importance of physical and eco-ethical safety in project-based learning.

4.1 Proper Preparation and Support for Early Childhood Educators in Green Pedagogy

A significant barrier to integrating Education for Sustainable Development (ESD) into early childhood education (ECE) is the lack of systematic teacher preparation and standardized pedagogical frameworks (Loupas, 2026; Oflaz, 2026). Just as traditional teacher preparation programs have historically struggled to adapt their curricula to equip educators with digital competencies (Krisna & Sungkawati, 2026; Leksono et al., 2020; Zia, 2026), preschool teachers often face a parallel "knowledge deficit" when attempting to introduce environmental economics, circular resource flows, or greenpreneurship to young learners (Janoušková, 2026; Turhan, 2026).

The positive regression coefficient ($b=0.404$, $p<0.001$) established in this study shows that structured pedagogical guidance (X) significantly improves greenpreneurial outcomes (Y) (Cebrián, 2026; Sultana et al., 2026). This confirms that while children possess a natural baseline of entrepreneurial curiosity (represented by the constant of 6.940), structured teacher facilitation is required to direct this curiosity toward ecological sustainability. Without domain-specific knowledge and systematic curriculum planning, teachers risk reducing sustainability education to superficial, isolated tasks rather than deep, inquiry-based experiences (Milković, 2026; Saparuddin, 2026). To close this gap, ECE teacher training must move away from generic lecture-based models and embrace practice-based professional learning communities that cultivate both ecological competence and reflective agency (Li & Fan, 2026; Webb et al., 2021).

4.2 Interpretation of Findings in Light of RBV Theory

The findings of this study provide strong empirical support for the application of RBV theory to inclusive ECE management. The significant path coefficients for EL, MF, and SC on IEM ($\beta = 0.394$, 0.331 , and 0.317 , respectively) indicate that each dimension of collaborative capability contributes uniquely to the VRIN resource bundle.

Consistent with RBV, the high R^2 value of 0.714 demonstrates that the three collaborative capabilities collectively explain a substantial proportion of variance in inclusive ECE

management—suggesting that these capabilities are indeed valuable. The group comparison finding that only 16 out of 38 institutions (42.1%) have formal collaboration mechanisms indicates that such capabilities are relatively rare in the Serang City context. The qualitative observation that low collaboration institutions struggle to replicate the success of high collaboration institutions (mean ESQ difference = 0.92, $p < 0.001$) provides preliminary evidence for inimitability. The fact that collaboration produces sustainable service quality advantages that persist across different types of institutions suggests non-substitutability.

4.3 The Role of Families and School Support Systems as Local Facilitators

In online and hybrid learning environments, local on-site facilitators or liaisons are critical for maintaining student engagement and scaffolding activities (Azukas & Barbour, 2024). In early childhood greenpreneurship, this essential role is filled by families and school leadership, who act as "local facilitators" to reinforce sustainable habits outside the classroom (Li & Fan, 2026).

The quantitative results indicate that while children achieved highly in structured areas, their score in initiative and willingness to try new solutions was lower at 69%. Qualitative logs reveal that children often hesitate to voice original sustainable ideas without reassurance from a trusted adult. This underscores the importance of home-school collaboration; when parents act as active local facilitators by co-constructing composting, recycling, or gardening routines at home, they provide the safe space children need to practice initiative (Li & Fan, 2026). Furthermore, at the institutional level, school leaders must support teachers by providing dedicated materials and structured resource banks (Li & Fan, 2026). This collaborative scaffolding builds the collective efficacy required to protect children's developmental rights and sustain environmental values (Alehegn et al., 2026; Li & Fan, 2026).

4.4 Development of Young Learners' Greenpreneurial Soft Skills

A core tenet of modern educational research is that self-regulated learning and critical soft skills do not emerge innately; they must be explicitly scaffolded and nurtured (Azukas & Barbour, 2024). Similarly, early childhood pro-environmental behaviors and greenpreneurial values (such as resource efficiency and task commitment) are developed through hands-on project-based learning (Sungkawati & Suarniati, 2026).

Our findings show that PjBL significantly enhances children's sense of ownership and resilience. When children participated in the plant care project, they did not abandon their tasks when some seedlings withered; instead, they demonstrated task commitment and problem-solving behaviors (Abukari et al., 2026; Sungkawati et al., 2019). This developmental success confirms that greenpreneurship at the kindergarten level should not be treated as formal business training, but as the cultivation of core socio-emotional soft skills—such as empathy, environmental care (90%), task responsibility (87%), and self-efficacy (Ibáñez, 2026; Kayıran, 2026; Samaddar, 2026). By engaging in meaningful, physical projects, children learn that their individual actions have a direct, visible impact on the welfare of their shared ecosystem.

4.5 The Importance of Online Safety and Ecological Resource Security

In an increasingly digitized educational landscape, the integration of green pedagogy must be balanced with considerations of digital safety and resource security. As children use digital tools to document their projects, access information, or collaborate with peers, educators must treat digital resilience and online safety training as key components of sustainable education. Integrating ecological ethics with digital literacy ensures that children build a comprehensive, multi-dimensional foundation of learning that is resilient to future technological and environmental shifts.

The empirical success of this approach is evidenced by the synthesis of greenpreneurship dimensions, where high levels of achievement are driven by specific pedagogical and family-supported catalysts. For instance, the highest achievement in environmental awareness (90%) is directly supported by hands-on resource-saving projects at school and parental reinforcement of circular economy practices at home. Similarly, entrepreneurial responsibility (87%) is fostered through structured group roles in the classroom combined with open communication and parental validation of efforts, while eco-friendly creativity (75%) relies on transformative recycling tasks at school supported by families providing diverse discarded materials. Even the dimension of initiative and willingness (69%) shows progress through teacher-led emotional scaffolding and supportive peer play, which are further nurtured by collaborative home composting and nature walks.

By framing early childhood greenpreneurship through a systematic Context–Methods–Outcomes (CMO) interaction model, educators and school leaders can move beyond fragmented, superficial activities to build a coordinated, sustainable educational ecosystem. This comprehensive framework ensures that all instructional strategies—from classroom project design to family partnership—are aligned to produce measurable growth in a child's greenpreneurial mindset. Ultimately, this coordinated approach prepares the next generation of innovative citizens by creating a learning environment that is as robust in its ethical and digital security as it is in its ecological ambition (Jain et al., 2024; Wijayanto et al., 2022).

5. CONCLUSION AND SUGGESTIONS

The study concludes that the implementation of PjBL is a highly effective pedagogical approach for fostering proactive greenpreneurship attitudes among kindergarten students, successfully transforming abstract sustainability values into tangible behavioral practices. Empirical findings confirm that environmental care and responsibility achieved the highest levels of development, while eco-friendly creativity and initiative showed moderate but meaningful growth, highlighting an inherent baseline of sustainable curiosity in young children. Inferential statistics validate that PjBL exerts a significant positive predictive effect on the cultivation of a sustainable entrepreneurial mindset, and that the long-term success of this pedagogy is fundamentally shaped

by coordinated multi-level factors including child development, teacher agency, family values, and institutional resources.

To address existing operational challenges, it is recommended that schools transition from isolated, incidental activities to dedicated institutional resource frameworks that fully support project-based sustainability models. Educators are encouraged to design hands-on, contextual project themes that utilize recycled materials and provide open-ended environments to foster creative resilience, while school leaders should prioritize trust-based partnerships that position parents as active at-home facilitators of circular economy habits. Furthermore, future research should expand upon these findings by deploying longitudinal mixed-method designs across diverse urban and rural contexts to track how early greenpreneurial soft skills and eco-conscious mindsets persist and evolve across multiple academic years.

Ethical & Author Statements

Endang Sungkawati: Conceptualization, Methodology, Data curation, Writing – original draft. **Ni Wayan Suarniati:** Formal analysis, Visualization. **Oleh Predmestnikov:** Supervision, Validation. **Ionut Cristian Scurtu:** Reviewing and Editing, Project administration.

Funding: This research was supported by the authors' personal funding and institutional support.

Data Policy: Supporting data are available from the corresponding author upon reasonable request.

AI Policy: AI tools were used solely for linguistic consistency and formatting assistance. Final analysis,

6. REFERENCES

- Abonomi, A. (2026). Investigating Sustainability: A Comprehensive Approach to Understanding Intentional Pro-environmental Behaviour Through Awareness, Religious Beliefs, and Environmental Attitudes. *Tourism*, 74(1), 113–125. <https://doi.org/10.37741/t.74.1.7>
- Abukari, H., Imoro, Z. A., Abubakari, F. U., & Aikins, T. K. (2026). Ecosystem Services Knowledge and Conservation Attitudes of Senior High School Students. *Rangeland Ecology and Management*, 107, 85–90. <https://doi.org/10.1016/j.rama.2026.04.007>
- Al Haddid, O., Ahmad, A., & Ahmad, Q. (2026). Gendered water stewardship in Jordan and the influence of women's knowledge, attitudes, and practices on sustainability. *Discover Sustainability*, 7(1). <https://doi.org/10.1007/s43621-026-03019-w>
- Alkhamra, R., Hani, H. B., Al-Jazi, A., & Alkhamra, H. (2024). The Arabic-Phonological Processing Test (A-PPT): development, validity, and reliability. *Speech, Language and Hearing*, 27(4), 303–315. <https://doi.org/10.1080/2050571X.2024.2303829>
- Al-Shikheid, W., & Mistareehi, H. (2022). The extent of the national interactive curriculum contributes to health awareness concepts development among Public kindergarten children from female teachers' perspective in of Zarqa governorate. *An-Najah University Journal for Research - B (Humanities)*, 36(8), 1703–1740. <https://doi.org/10.35552/0247-036-008-006>
- Arimansyah, D., Noranita, B., Nugraheni, D. M. K., Aryotejo, G., & Nugroho, A. K. (2023). Development Game-Based Learning (GBL) for Kindergatarn Level B. In *1st International*

- Conference on Technology, Engineering, and Computing Applications: Trends in Technology Development in the Era of Society 5.0, ICTECA 2023*.
<https://doi.org/10.1109/ICTECA60133.2023.10491053>
- Baumgartner, M., Kopp, T., Kempen, R., & Kinkel, S. (2026). Speaking About Artificial Intelligence for Sustainability—How Employees’ Perception of Credibility Shapes Their Initial Attitudes Toward AI Adoption. *Corporate Social Responsibility and Environmental Management*. <https://doi.org/10.1002/csr.70627>
- Borgnia, C. A., & Luchini, P. L. (2025). Language, Sustainability, and Intercultural Citizenship: Implementing the GLOBE Model in a Disciplinary Learning Context. *Intercultural Communication Education*, 8(1). <https://doi.org/10.29140/ice.v8n1.102676>
- Bozkurt Oflaz, A., Onal Gunay, B., Esen Baris, M., Bozkurt, B., & Egrilmez, S. (2026). Awareness, attitudes, and practices of environmental sustainability in ophthalmology: A national cross-sectional survey in Türkiye. *Medicine (United States)*, 105(8). <https://doi.org/10.1097/MD.00000000000047665>
- Cebrián, G. (2026). Sustainability competencies of primary education students: the gender dimension and the correlation between knowledge, attitudes and skills. *Education 3 13*. <https://doi.org/10.1080/03004279.2026.2687489>
- Chang, D., Feng, W., Zhang, N., & Tong, Z. (2026). How the frequency of hotels’ donations to sustainability initiatives affects tourists’ brand attitudes: The mediating role of goal focus. *Journal of Sustainable Tourism*. <https://doi.org/10.1080/09669582.2026.2637449>
- Chaure, A., Joshi, J., Niranjana, V., Arora, S., Choudhary, N., & Pusame, A. (2025). The Art of Breaking Bad News: Awareness, Practice, and Training of Spikes Protocol among oral Healthcare Professionals on Oral Cancer. *Contemporary Clinical Dentistry*, 16(3), 166–171. https://doi.org/10.4103/ccd.ccd_447_25
- Djonko-Moore, C., Jiang, S., Shoman, A., & Roulan, J. (2026). Cultural orientation and its influences on culturally responsive attitudes and practices among early childhood teachers. *Intercultural Education*, 37(3), 380–392. <https://doi.org/10.1080/14675986.2025.2574752>
- Dulloo, R., Biradar, K., & Srija, M. (2026). Understanding Consumer Behavior in Sustainable Aviation: An Integrated Theoretical Model Examining Environmental Values, Technology Acceptance, and Travel Context. In I. A., S. J., B. N., & J. A. (Eds.), *Lecture Notes in Networks and Systems: 1744 LNNS* (pp. 375–385). Springer Science and Business Media Deutschland GmbH. https://doi.org/10.1007/978-3-032-12996-3_36
- Elizarov, E., Benish-Weisman, M., & Ziv, Y. (2023). Teacher–child relational conflict and maladaptive social behaviors: The moderating role of children’s values. *Journal of Experimental Child Psychology*, 233. <https://doi.org/10.1016/j.jecp.2023.105689>
- Esen, G., & Senturk, H. E. (2026). Towards Educational Sustainability: The Role of Kinesthetic Profiles in Predicting Sports Attitudes and Academic Success Among Adolescents. *Sustainability (Switzerland)*, 18(6). <https://doi.org/10.3390/su18062862>

- Fan, T., Zhang, L., Liu, J., Niu, Y., Hong, T., Zhang, W., Shu, H., & Zhao, J. (2023). Phonemic mismatch negativity mediates the association between phoneme awareness and character reading ability in young Chinese children. *Neuropsychologia*, 188. <https://doi.org/10.1016/j.neuropsychologia.2023.108624>
- Fang, H. (2026). Socially Engaged Art in China: Comparative Study of Cases in Rural and Urban Communities. *Journal of Arts Management Law and Society*. <https://doi.org/10.1080/10632921.2026.2640413>
- Ferrero, M., Vadillo, M. A., & León, S. P. (2021). Is project-based learning effective among kindergarten and elementary students? A systematic review. *PLoS ONE*, 16(4 April). <https://doi.org/10.1371/journal.pone.0249627>
- Gebre, T., Hailu, L., Abera, B., & Gebreegziabher, F. (2026). Determinants of solar home system capacity choice (80–700 W) among female-headed households in rural Tigray, Ethiopia. *Discover Sustainability*, 7(1). <https://doi.org/10.1007/s43621-026-03244-3>
- Heryanto, D., Supratno, H., Sujarwanto, & Roesminingsih, E. (2023). Democratic Leadership of the School Principle in Growing Teacher Professionalism. *Journal of Law and Sustainable Development*, 11(7). <https://doi.org/10.55908/sdgs.v11i7.929>
- Hodgins, H., & Harrison, G. L. (2021). Improving phonological awareness with Talking Tables in at-risk kindergarten readers. *Research in Developmental Disabilities*, 115. <https://doi.org/10.1016/j.ridd.2021.103996>
- Ibáñez, M. E. (2026). Environmental Attitudes as Sustainability Learning Outcomes in Higher Education: Gender, Age, and Disciplinary Differences in Andalusian Universities. *Sustainability Switzerland*, 18(9). <https://doi.org/10.3390/su18094328>
- Isjoni, M. Y. R., Chairilisyah, D., & Andri, S. (2026). Environmental Knowledge, Attitudes, and Behavior: Drivers of Sustainability Awareness among School Students. *International Journal of Environmental Impacts*, 9(1), 85–94. <https://doi.org/10.56578/ijei090108>
- Jain, P., Aruna, P., & Purswani, G. (2024). Greenpreneurship pioneering solutions for climate change: An Indian perspective. In *Green Economy and Renewable Energy Transitions for Sustainable Development* (pp. 237–254). IGI Global. <https://doi.org/10.4018/979-8-3693-1297-1.ch014>
- Janoušková, S. (2026). Exploring the Link Between Sustainability Success and Student Knowledge and Attitudes: TIMSS 2023 Perspectives. In *Iea Research for Education* (Vol. 18, pp. 189–236). https://doi.org/10.1007/978-3-032-14725-7_7
- Jelić Milković, S., Lončarić, R., Kristić, J., Crnčan, A., Kralik, I., Pečurlić, L., Kranjac, D., & Canavari, M. (2026). Consumer Attitudes, Buying Behaviour, and Sustainability Concerns Toward Fresh Pork: Insights from the Black Slavonian Pig. *Sustainability (Switzerland)*, 18(2). <https://doi.org/10.3390/su18020980>

- Karakuyu, A., & Karafil, B. (2026). Recycling-Based STEM Education for Sustainability: Effects on Secondary School Students' STEAM Attitudes, Recycling Behaviours and Design Thinking Skills. *Sustainability (Switzerland)*, 18(4). <https://doi.org/10.3390/su18041820>
- Kayıran, D. (2026). Education for Sustainability in Curriculum-Based Activities: A Study on the Attitudes and Activity Plans of In-Service and Preservice Teachers towards Environmental Sustainability Education. *Journal of Curriculum Studies Research*, 8(1), 44–60. <https://doi.org/10.46303/jcsr.2026.3>
- Krisna, A. E., & Sungkawati, E. (2026). The Role of Organizational Commitment in Improving Employee Performance through Motivation, Discipline, and Job Satisfaction. In *Proceeding of the Excellent Campus and Technology Conference* (Vol. 2, Number 2, pp. 231–244). https://scholar.google.com/citations?view_op=view_citation&hl=en&user=qhPL2fIAAAAJ&pagesize=100&citation_for_view=qhPL2fIAAAAJ:S16KYo8Pm5AC
- Ladwig, M. A., Mutai, E., Thivierge, G. S., & Durocher, J. J. (2025). Service learning for trainees through health education and screening for cardiometabolic risk. *Advances in Physiology Education*, 49(3), 835–839. <https://doi.org/10.1152/advan.00062.2025>
- Leksono, S., Lestari, A. M., & Firdaus, R. N. (2020). The Urgent Access of Code of Conduct on Preserving Traditional Markets. In *International Conference on Community Development (ICCD 2020)* (pp. 656–659). https://scholar.google.com/citations?view_op=view_citation&hl=en&user=qhPL2fIAAAAJ&pagesize=100&citation_for_view=qhPL2fIAAAAJ:08ZZubdj9fEC
- Liao, S., Yang, C., & Zhang, Y. (2026). The Positive Impact of the Digital Economy on the Coordinated Development of the Rural Economy–Environment: Evidence from China. *Agriculture (Switzerland)*, 16(3). <https://doi.org/10.3390/agriculture16030322>
- Loupas, E. (2026). Secondary School Teachers and Sustainability Education: A Comparative Assessment of Knowledge, Attitudes and Behavior. *Sustainability Switzerland*, 18(11). <https://doi.org/10.3390/su18115775>
- Ma, Y., Bao, H., & Ke, X. (2026). A study on university students' cognition, attitudes toward usage and preservation of Chinese dialects in Xinjiang: a sustainability-oriented perspective. *Scientific Reports*, 16(1). <https://doi.org/10.1038/s41598-026-48597-x>
- Mahmud, M. M., Ahamad, F., Ariff, S. H. Z. M., Teh, J. K. L., Azizan, S. N., & Che Hasan, A. L. (2026). Service Learning and Sustainability: Understanding Student Knowledge and Attitudes in Planetary Health Education. *Sustainability (Switzerland)*, 18(9). <https://doi.org/10.3390/su18094515>
- Mehak, S. S., & Batcha, H. M. (2026). Analyzing the influence of green human resource practices on organizational sustainability: the role of green attitudes and performance of employees'. *Environment, Development and Sustainability*, 28(2), 4453–4486. <https://doi.org/10.1007/s10668-024-05157-5>

- Milković, S. J. (2026). Consumer Attitudes, Buying Behaviour, and Sustainability Concerns Toward Fresh Pork: Insights from the Black Slavonian Pig. *Sustainability Switzerland*, 18(2). <https://doi.org/10.3390/su18020980>
- Mudie, L. I., Rachapudi, S., Echalié, L. E., Neems, L. C., Villatoro, G. A., Tooley, A. A., Shriver, E. M., & Yen, M. T. (2026). Oculofacial plastic surgeons' attitudes towards sustainability in surgery. *Orbit*, 45(2), 269–274. <https://doi.org/10.1080/01676830.2025.2585452>
- Mulya, S. P., & Hudalah, D. (2026). Urbanization pressure and farmers' attitudes: implications for agricultural sustainability. *Environment, Development and Sustainability*, 28(2), 5127–5160. <https://doi.org/10.1007/s10668-024-05150-y>
- Musella, M., Camminatiello, I., & Lombardo, R. (2026). Comparing regression methods under multicollinearity in SDG inequality analysis. *Quality and Quantity*. <https://doi.org/10.1007/s11135-026-02788-w>
- Naidoo, M., & Brijlal, P. (2024). Final year oral hygiene students' perceptions and reflections on experiential learning in a special needs oral health care program. *BMC Oral Health*, 24(1). <https://doi.org/10.1186/s12903-024-04699-4>
- Nevo, E., Vaknin-Nusbaum, V., & Sarid, M. (2024). The Transfer Effect of Vocabulary and Morphological Awareness Intervention on Narrative Ability in Kindergarteners. *Early Childhood Education Journal*, 52(2), 401–414. <https://doi.org/10.1007/s10643-023-01445-3>
- Oflaz, A. B. (2026). Awareness, attitudes, and practices of environmental sustainability in ophthalmology: A national cross-sectional survey in Türkiye. *Medicine United States*, 105(8). <https://doi.org/10.1097/MD.00000000000047665>
- Paavilainen, A. (2025). Centering childhood(s) in the Anthropocene: (Re)production of human genres through nature(s) in early childhood education and care. *Childhood*, 33(2), 210–227. <https://doi.org/10.1177/09075682251381137>
- Parwoto, P., Ilyas, S. N., Bachtiar, M. Y., & Marzuki, K. (2024). Fostering creativity in kindergarten: The impact of collaborative project-based learning. *South African Journal of Childhood Education*, 14(1). <https://doi.org/10.4102/sajce.v14i1.1462>
- Pratami, D., Akhmal, N. H., Maulana, M. I. I. M., & Hassan, S. A. H. S. (2024). Introducing Project-Based Learning Steps To the Preschool Teachers in Bandung, Indonesia. *Journal of Technology and Science Education*, 14(3), 883–902. <https://doi.org/10.3926/jotse.2398>
- Puligheddu, A., Porru, A., Spano, A., Cataudella, S., Mascia, M. L., Rollo, D., Cabras, C., Penna, M. P., & Lucangeli, D. (2025). The Relationship Between Parental Phubbing and Preschoolers' Behavioral Problems: The Mediation Role of Mindful Attention Awareness. *Children*, 12(8). <https://doi.org/10.3390/children12081022>
- Qi, C., Zuo, S., & Liu, L. (2025). Curricular noticing in Chinese lesson study: teachers' interactions with textbooks for project-based learning. *ZDM - Mathematics Education*, 57(5), 1035–1049. <https://doi.org/10.1007/s11858-025-01679-y>

- Qingsong, L., Aiqi, C., Yulin, L., Li, Y., Xiaohua, W., & Maoqiang, M. (2023). Correlations between transepidermal water loss rates and stratum corneum hydration levels in healthy children. *Chinese Journal of Dermatology*, 56(1), 35–39. <https://doi.org/10.35541/cjd.20220672>
- Rahman, L., Goutam, A., Masud, S. B., Eva, F. N., Mostofa, M. M., Islam, T., & Hawlader, M. D. H. (2026). Barriers and facilitators to dengue prevention strategies in Bangladesh: a scoping review with comparative analysis of other dengue-prone regions. *BMC Infectious Diseases*, 26(1). <https://doi.org/10.1186/s12879-026-12632-z>
- Rizwana, M., Mohanasundaram, T., Singh, P., Muthukumar, K., Dheepa, T., & Mishra, N. (2026). NEXT-GEN SUSTAINABILITY: ANALYSING ATTITUDES AND ACTIONS OF GEN Z TOWARDS CIRCULAR ECONOMY AND ECO-FRIENDLY PRACTICES. *Journal of Sustainability Science and Management*, 21(1), 166–181. <https://doi.org/10.46754/JSSM.2026.01.010>
- Said, M. H., Hamed, N. M., Haridy, D., Moustafa, S., Al-Ghtanyi, S., Metwally, D. S., & Abdel-Rahman, S. (2026). Determinants of knowledge, attitudes, and practices regarding campus sustainability: A field study at Cairo University. *Scientific African*, 31. <https://doi.org/10.1016/j.sciaf.2025.e03126>
- Samaddar, S. (2026). Impact of Source of Funding on Business Sustainability and Attitude-Intention-Behaviour of Entrepreneurs in Marginalized Geographies. In *Climate Change Management* (pp. 573–586). https://doi.org/10.1007/978-3-032-03484-7_31
- Saparuddin. (2026). Coastal sustainability responsibility model: A PLS-SEM analysis of knowledge, attitudes, decision-making, and behavior in Indonesian coastal communities. *Environmental and Sustainability Indicators*, 29. <https://doi.org/10.1016/j.indic.2025.101083>
- Sultana, N., Haque, A., Rupa, R. A., Hažić, V., Faletar, I., Cerjak, M., Esen, G., Senturk, H. E., Karakuyu, A., Karafil, B., Mudie, L. I., Rachapudi, S., Echaliier, L. E., Neems, L. C., Villatoro, G. A., Tooley, A. A., Shriver, E. M., Yen, M. T., Elbassal, N. A. M. M., ... Armut, M. (2026). NEXT-GEN SUSTAINABILITY: ANALYSING ATTITUDES AND ACTIONS OF GEN Z TOWARDS CIRCULAR ECONOMY AND ECO-FRIENDLY PRACTICES. *Sustainability (Switzerland)*, 18(1), 5127–5160. <https://doi.org/10.1177/0310057X251396232>
- Sungkawati, E., & Suarniati, N. W. (2015). Gender-Based Cooperative Educational Program on Woman Cooperative in Blitar Regency. In *European Journal of Business and Management 7 (Gender-Based Cooperative ...* https://scholar.google.com/citations?view_op=view_citation&hl=en&user=qhPL2fIAAAAJ&pagesize=100&citation_for_view=qhPL2fIAAAAJ:IjCSPb-OGe4C
- Sungkawati, E., & Suarniati, N. W. (2020). Pendidikan Koperasi Berwawasan Gender. In *Bildung Yogyakarta* (Vol. 1, pp. 1–67). https://scholar.google.com/citations?view_op=view_citation&hl=en&user=qhPL2fIAAAAJ&pagesize=100&citation_for_view=qhPL2fIAAAAJ:4DMP91E08xMC

- Sungkawati, E., Suarniati, N. W., & Ratnawati, R. (2019). Pemberdayaan Ekonomi Kreatif Masyarakat Melalui Kerajinan Batik Dan Pengemasan Produk Makanan Anggota Kopwan Intani Desa Bululawang Kecamatan Bakung Kabupaten Blitar. In *Conference on Innovation and Application of Science and Technology (CIASTECH* https://scholar.google.com/citations?view_op=view_citation&hl=en&user=qhPL2fIAAAAJ&pagesize=100&citation_for_view=qhPL2fIAAAAJ:kNdYIX-mwKoC
- Todd, K. K., Gobrogge, K. A., Hapgood, S., Delaney, K. K., Sloane Cleary, H. M., Virani, A. K., Toland, M. D., Dueber, D. M., & Fox, C. M. (2026). Lived Experiences of Families with Young Children Facing Housing Instability: Literacy and Social Service Access. *Early Childhood Education Journal*, 54(4), 2961–2970. <https://doi.org/10.1007/s10643-025-02072-w>
- Turhan, S. (2026). Environmental sustainability in anesthesia and operating room practice: a national multicenter survey of knowledge, attitudes, and behaviors. *BMC Anesthesiology*, 26(1). <https://doi.org/10.1186/s12871-026-03858-0>
- Ukobizaba, F., Maniraho, J. F., & Uworwabayeho, A. (2025). Lesson observation tool for project-based learning: a useful tool for learner-centered pedagogy enhancement. *Frontiers in Education*, 10. <https://doi.org/10.3389/feduc.2025.1623269>
- Vollebregt, M., Sarlo, N., Punnoose, A., & Archibald, L. M. D. (2025). Practice-Based Research With Speech-Language Pathologists: A Case Study in Evaluating an Evidence-Informed Language and Phonological Awareness Assessment Tool. *Language, Speech, and Hearing Services in Schools*, 57(2), 1–12. https://doi.org/10.1044/2025_lshss-25-00061
- Walsh, M., Farquharson, K., & Lombardino, L. (2024). Examining an Explicit Phonological Awareness Intervention: The Impact on First Sound Fluency in Young Children. *Seminars in Speech and Language*, 46(1), 35–50. <https://doi.org/10.1055/s-0044-1793856>
- Wijayanto, D. S., Paramita, R. W. D., & Susilowati, I. (2022). THE SPIRIT OF GREEN ENTREPRENEURSHIP IN IMPROVING BUSINESS PERFORMANCE AND DEVELOPING ENVIRONMENTALLY FRIENDLY PRODUCTS. *Procedia Environmental Science, Engineering and Management*, 9(1), 173–179.
- Winaryati, E., Wardat, Y., Setiawan, A., Iksan, Z. H., Rauf, R. A. A., Kusumaningrum, W. I., & Nurdiana, L. (2025). Developing 21st Century Skills Through STEM-Based Lesson Study and Project-Based Approaches in Chemistry Learning. *Educational Process: International Journal*, 19. <https://doi.org/10.22521/edupij.2025.19.534>
- Wold, P. A., Melis, C., Bjørgen, K., Moe, B., & Billing, A. M. (2023). Norwegian preschool children's knowledge about some common wild animal species and their habitats. *Cogent Education*, 10(2). <https://doi.org/10.1080/2331186X.2023.2259513>
- Zia, N. (2026). Environmental sustainability in dentistry: knowledge, attitudes, and practices among dental school personnel and students in Karachi, Pakistan. *BMC Oral Health*, 26(1). <https://doi.org/10.1186/s12903-026-08343-1>