European Journal of Education Studies
ISSN: 2501 - 1111
ISSN-L: 2501 - 1111
Available online at: www.oapub.org/edu

DOI: 10.46827/ejes.v12i5.5997 Volume 12 | Issue 5 | 2025

ENVIRONMENTAL KNOWLEDGE AS A MEDIATOR BETWEEN PERCEIVED GREEN INCLUSIVE LEADERSHIP AND STUDENT GREEN CREATIVITY

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Abstract:
Guided by Amabile's Componential Theory of Creativity (CTC), this study tested a mediation model to assess how college students' perceptions of green inclusive leadership (PGIL) affect their green creativity (GY) via environmental knowledge (EK). Data from 598 students at two Chinese colleges, collected through convenience sampling using structured questionnaires, were analyzed with the PROCESS macro. Results confirmed that PGIL positively influenced GY, with EK mediating this relationship. The findings validate the integration of PGIL within the CTC framework, addressing gaps in understanding motivational drivers of GY. This research uniquely applies CTC to sustainability education, offering theoretical and practical insights into fostering GY through green leadership in academic settings.

Keywords: perceived green inclusive leadership; environmental knowledge; green creativity; college students

1. Introduction

Amid escalating environmental crises, contemporary college students confront the consequences of historical environmental neglect and present-day apathy, yet simultaneously hold pivotal roles in acquiring technical expertise to address these

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challenges (Liu, 2023). Scholars emphasize the urgency of cultivating creative competencies in students to tackle complex sustainability issues (Clark *et al.,* 2020), though current curricula demonstrate limited integration of creativity education with environmental research and sustainable development (Cheng, 2019; Saleh & Brem, 2023). Green creativity (GY), an ethically oriented dimension of creativity focused on sustainability and societal value creation (Bhutto *et al.,* 2022; Chen *et al.,* 2014), has emerged as a critical target for higher education institutions (HEIs). These institutions face mounting pressure to embed ecological education into their social mandates, fostering sustainability-driven GY that aligns environmental preservation with future socioeconomic advancement (Clark *et al.,* 2020; Rodríguez-Chueca *et al.,* 2020). Consequently, nurturing students' environmentally protective creativity constitutes a strategic imperative for steering societal transitions toward sustainability.

Supervisory leadership emerges as a critical determinant of individuals' GY development (Arici & Uysal, 2022; Li *et al.,* 2020). Within educational contexts, inclusive leadership frameworks prove particularly relevant for managing diversity (Rayner, 2009), with prior research establishing links between inclusive leadership and creative outcomes (Javed *et al.,* 2019; Zhu & Zhang, 2019). The evolving concept of green inclusive leadership (GIL) synthesizes environmental consciousness with diversity management, positioning itself as a catalyst for sustainability-oriented creativity (Aboramadan *et al.,* 2021; Bhutto *et al.,* 2022). While GIL's potential to advance university sustainability agendas through GY enhancement is recognized, empirical evidence remains scarce (Liu, 2024), underscoring the need to investigate how PGIL influences students' eco-creative capacities.

Addressing these theoretical and practical gaps, this study employs Amabile's Componential Theory of Creativity (CTC) to examine the mechanisms underlying PGIL-GY relationships. The CTC framework postulates that creativity arises from dynamic interactions between environmental influences and individual competencies (Amabile, 1988), with leadership serving as a critical contextual factor shaping creative processes (Li *et al.,* 2020). Environmental knowledge (EK), a core individual component in creativity models (Amabile, 1983; Amabile & Mueller, 2008), is theorized to mediate leadership's impact on creative outcomes (Meng & Zhao, 2018). However, current GY research inadequately addresses this mediation mechanism (Liu & Liu, 2023; Sürücü, 2024). This investigation, therefore, tests hypotheses regarding EK's mediating role between PGIL and GY, aiming to elucidate cognitive pathways through which academic leadership fosters sustainability-oriented creativity. By applying CTC to green creativity contexts, the study seeks to advance theoretical understanding while informing practical strategies for embedding sustainability innovation in higher education systems.

2. Literature Review

2.1 PGIL and GY

GY carries substantial societal value, particularly in advancing environmental sustainability (Chen & Chang, 2013). It encompasses individuals' capacity to generate novel solutions to ecological challenges, advocate for sustainable concepts, and develop impactful green products, practices, or services (Li *et al*., 2020; Zhang *et al*., 2020). This form of creativity is shaped by contextual and personal determinants, consistent with the CTC, which underscores the interplay between leadership and individual factors (Amabile & Mueller, 2008).

Inclusive leadership, characterized by relationship-building strategies that enhance interpersonal connections, demonstrates measurable effects on innovation and creative outcomes (Fang *et al*., 2019; Javed *et al*., 2019). Aligning conceptually with ethical, servant, and transformational leadership paradigms, this approach facilitates learning and professional growth (Avolio & Bass, 2002; Stone *et al*., 2004; Wang & Howell, 2010), with scholars recognizing its core relational mechanisms (Korkmaz *et al*., 2022). This investigation specifically examines Green Inclusive Leadership (GIL), a sustainability-focused variant that cultivates individual distinctiveness, fosters environmental engagement, and supports eco-innovation initiatives (Korkmaz *et al*., 2022). GIL practitioners employ open dialogue on ecological issues, encourage participatory problem-solving, and validate green contributions (Thab *et al*., 2023), with empirical evidence linking GIL to enhanced pro-environmental behaviors and GY development (Bhutto *et al*., 2022).

While scholarly attention has extensively explored green transformational leadership's influence on GY (Mansoor *et al*., 2021; Mittal & Dhar, 2016; Zhang *et al*., 2020), GIL's specific impact remains underexamined (Liu, 2024). Research on GY cultivation among college students within academic environments constitutes an emerging field. Given GIL's documented organizational benefits for environmental stewardship, its classroom implementation through PGIL may similarly stimulate student GY. Prior studies establish parallels between teacher-student dynamics and workplace leadership frameworks, positioning educators as organizational influencers (Bolkan *et al*., 2011; Chory & McCroskey, 1999). This conceptual alignment suggests **that** PGIL demonstrated by instructors could critically shape students' sustainability-oriented creativity. The study**,** therefore**,** hypothesizes:

H1: PGIL has a significant positive effect on GY.

2.2 The Mediating Role of EK

Professional knowledge constitutes the foundational substrate for creative development, with creative cognition representing its critical operationalization (Meng & Zhao, 2018). Environmental knowledge (EK), defined as "*comprehensive understanding of factual information, conceptual frameworks, and systemic interrelationships within natural ecosystems*" (Fryxell & Lo, 2003, p. 45), EK encompasses awareness of anthropogenic-environmental

interactions, ecological challenges, and complex ecosystem dynamics (Burchett, 2015). This knowledge domain equips individuals with competencies to mitigate ecological degradation through environmentally responsible actions. Within GIL frameworks, practitioners receive guidance on sustainable concepts, methodological approaches, and technological advancements in environmental fields. PGIL implementation creates structured opportunities for individuals to cultivate professional expertise and engage in eco-innovation processes (Aboramadan *et al*., 2022; Bhutto *et al*., 2022).

GIL stimulates intellectual engagement with sustainability challenges through enhanced curiosity and task commitment, while fostering resilience to challenge conventional paradigms and embrace calculated risks. Furthermore, it ensures resource allocation for concentrated learning by safeguarding temporal and cognitive investments in ecological studies (Liu, 2024). This theoretical synthesis positions GIL as a critical enabler of the creativity-enhancing EK component. Consequently, PGIL integration into educational settings is expected to strengthen collegiate learners' environmental knowledge acquisition. The study accordingly hypothesizes:

H2: PGIL is positively related to EK.

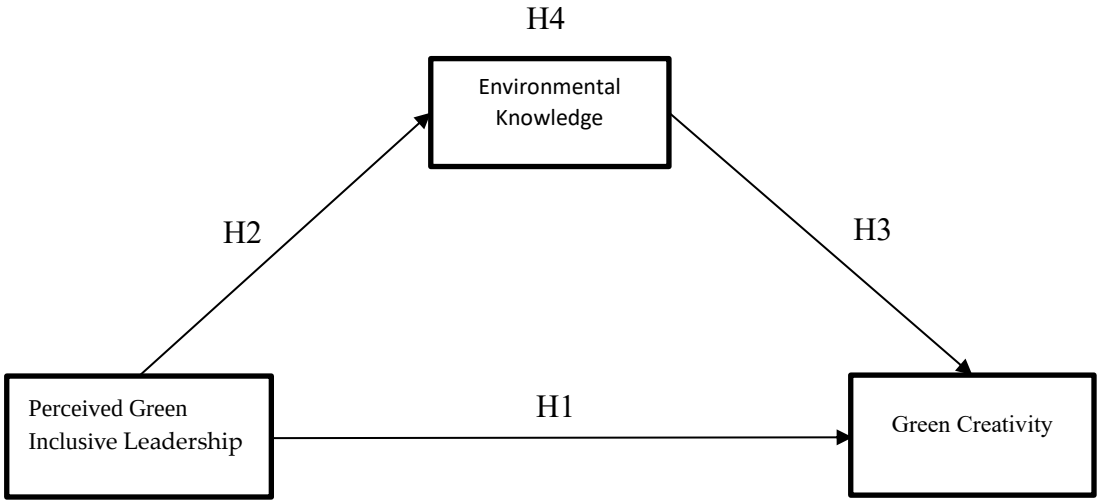
EK constitutes the cognitive foundation for formulating environmental research inquiries, defining investigative parameters, and disseminating ecological findings, while also encompassing evaluative expertise to assess the novelty and applicability of sustainability solutions (Akhondzadeh & Monfared, 2021). Empirical evidence demonstrates EK's substantial impact on shaping pro-environmental dispositions, as evidenced by its influence on university students' adoption of eco-friendly transportation alternatives (Mohiuddin *et al.,* 2018). Furthermore, advancements in Education for Sustainable Development (ESD) knowledge correlate strongly with enhanced ecological behavioral patterns among learners (Esa, 2010; Nousheen *et al.,* 2019). Recent empirical investigations have examined how green training, including knowledge, impacted green creativity in employees within an educational context, emphasizing their dual roles as learners. (Joshi & Dhar, 2020), with parallel findings emerging in subsequent studies (Ma *et al.,* 2025; Riva *et al.,* 2021). Nevertheless, the specific mechanisms through which EK influences GY development in collegiate populations remain inadequately explored, highlighting persistent empirical gaps in sustainability education research.

H3: EK is positively related to GY.

Scholarly investigations have established green knowledge acquisition as a critical mediating mechanism between green learning orientations and eco-innovative outcomes (Wang *et al.,* 2020). Furthermore, empirical research has validated environmental knowledge's mediating function across various sustainability contexts (Akhondzadeh & Monfared, 2021; Rubel *et al.,* 2020). Building on this evidence, the study hypothesizes:

H4: EK mediates the correlation of PGIL and GCRY.

Figure 1: Hypothetical Model



3. Methods

3.1 Participants and Procedures

The study recruited 598 participants from collegiate institutions in Hebei Province, China, selected for their demonstrated institutional commitment to ecological education. Data collection occurred through institutional email distribution lists and in-person classroom engagements. Participants were required to be enrolled in semester-long sustainability-focused elective courses under a single instructor as part of the selection criteria. Targeted institutions included a pioneering college in China's environmental education sector, operating under a government-endorsed environmental education initiative jointly administered by the Hebei Provincial Government and the Ministry of Ecology and Environment. Both participating colleges maintain recognized roles in fostering ecological awareness, with students demonstrating inherent environmental consciousness, thereby ensuring sample representativeness for educational sector analysis.

3.2 Measures

Perceptions of Green Inclusive Leadership (PGIL) were assessed through a 9-item instrument adapted from Carmeli *et al.* (2010), employed to evaluate instructors' leadership approaches in sustainability-themed elective courses. The scale demonstrated high reliability (Cronbach's $\alpha = 0.94$).

Environmental Knowledge (EK) was operationalized using a modified 5-item measure derived from Mostafa (2007), showing robust internal consistency (Cronbach's $\alpha = 0.86$).

Green Creativity (GY) utilized Chen and Chang's (2013) 6-item scale, which achieved strong reliability (Cronbach's $\alpha = 0.89$).

3.3 Data analyses

The analytical procedures utilized SPSS software for data processing. Preliminary analyses involved generating descriptive statistics and examining variable correlations. Hypothesis testing employed Hayes' (2017) PROCESS macro with Model 4 specifications to assess mediation effects. The mediation analysis incorporated 5,000 bias-corrected bootstrap resamples, establishing 95% confidence intervals to quantify indirect effects, thereby ensuring analytical robustness through nonparametric estimation of mediation pathways.

4. Results

4.1 Correlation Analysis

Preliminary analyses revealed significant positive associations among all study variables (Table 1). Pearson correlation coefficients demonstrated moderate intervariable relationships, ranging from 0.381 to 0.486 ($p < 0.001$). Specifically, PGIL exhibited statistically meaningful correlations with EK (r = 0.381, $p < 0.001$) and GY (r = 0.486, $p < 0.001$). Furthermore, EK showed a significant positive relationship with GY (r = 0.421, $p < 0.001$), confirming preliminary alignment with the hypothesized mediation framework. All correlations maintained statistical significance, establishing foundational support for subsequent mediation analyses.

Table 1: Descriptive statistics and correlations analysis

Variables	*M*	*SD*	PGIL	EK	GY
PGIL	4.077	0.997	1		
EK	4.097	0.633	0.381***	1	
GY	3.551	1.023	0.486***	0.421***	1

Note: *M*: Mean, *SD*: Standard deviations; PGIL: Perceived Green Inclusive Leadership; EK: Environmental Knowledge; GY: Green Creativity. ***$p < 0.001$.

4.2 Hypotheses Testing

The mediation analysis employing PROCESS Model 4 (Hayes, 2017) examined EK's role in the PGIL-GY relationship, with outcomes detailed in Table 2. Model 1 demonstrated PGIL's significant positive predictive effect on GY ($\beta = 0.499$, $p < 0.001$), confirming Hypothesis 1. Model 2 revealed PGIL as a significant antecedent of EK ($\beta = 0.242$, $p < 0.001$), with EK subsequently exhibiting a significant positive association with GY ($\beta = 0.445$, $p < 0.001$). In Model 3, PGIL maintained a significant direct effect on GY ($\beta = 0.391$, $p < 0.001$) after accounting for EK's mediation. The attenuation of PGIL's coefficient from 0.499 to 0.391 indicates partial mediation by EK, thereby substantiating Hypotheses 2, 3, and 4.

Table 2: Environmental Knowledge Mediation Model Analysis

Variables	Model 1		Model 2		Model 3	
	GY		EK		GY	
	β	*t*	β	*t*	β	*t*
PGIL	0.499	13.587***	0.242	10.074***	0.391	10.287***
EK					0.445	7.419***
R^2	0.236		0.145		0.301	
F	184.606***		101.477***		128.192***	

Note: PGIL: Perceived Green Inclusive Leadership; EK: Environmental Knowledge; GY: Green Creativity. ***$p < 0.001$.

Robustness testing for mediation effects utilized a bootstrapping approach with bias correction (5,000 resamples). The analysis demonstrated a significant indirect effect of PGIL on GY through EK (effect = 0.108, 95% CI [0.072, 0.151]), confirmed by the confidence interval excluding zero. Simultaneously, the persistent direct effect remained statistically significant (effect = 0.391, 95% CI [0.317, 0.466]), with the interval similarly spanning non-zero values. These results collectively establish EK's partial mediation role in the PGIL-GY relationship. Comprehensive mediation statistics are documented in Table 3.

Table 3: Mediation Effect with Bootstrapping

Path	Effect	95% LLCI	95% ULCI
Direct effects PGIL→GY	0.391	0.317	0.466
Indirect effects PGIL→EK→GY	0.108	0.072	0.151
Total effects PGIL→GY	0.499	0.427	0.571

Note: Bootstrap random sampling 5,000 times; LLCI: Lower limit of confidence interval; ULCI: Upper limit of confidence interval. PGIL: Perceived Green Inclusive Leadership; EK: Environmental Knowledge; GY: Green Creativity.

5. Discussion

This investigation empirically validates the interconnectedness of PGIL, EK, and GY among college students. The results substantiate Hypothesis 1 through a significant direct PGIL and GY relationship, aligning with emerging scholarship on GIL's capacity to stimulate GY (Liu, 2024). The findings underscore how GIL practitioners cultivate nonconventional evaluative frameworks that valorize individual distinctions, thereby establishing campus environments where students' ecological perspectives receive institutional validation. Such inclusive pedagogical ecosystems enhance learners' confidence in prototyping sustainable solutions, directly catalyzing GY development.

Hypothesis 2 gains empirical support through PGIL's significant predictive effect on EK, resonating with established literature on leadership shaping knowledge functions (Liu, 2024; Shafait & Huang, 2024). This outcome operationalizes the CTC by

demonstrating leadership's capacity to systematically transmit institutional sustainability commitments, thereby strengthening students' ecological literacy – a critical precursor for GY (Meng & Zhao, 2018). The results position academic leaders as pivotal actors in bridging environmental policy and classroom praxis.

The EK and GY linkage (Hypothesis 3) achieves statistically significant, extending prior organizational research into educational contexts (Ma *et al.*, 2025; Riva *et al.*, 2021). This finding operationalizes CTC's proposition that domain-specific knowledge amplifies creative motivation, revealing that students with robust EK demonstrate heightened agency in generating classroom-based environmental innovations. The alignment between ecological literacy and creative output suggests that knowledge internalization transforms passive learning into active sustainability co-creation.

Crucially, the statistical analysis confirms EK's partial mediation, supporting Hypothesis 4. This novel pathway elucidates how PGIL's influence bifurcates into direct GY and indirect EK-mediated effects, mirroring the CTC's creativity model (Meng & Zhao, 2018). The findings show that organizational studies (Riva *et al.*, 2021), in which EK explains eco-behavioral outcomes, establish academia-specific mechanisms through which leadership perceptions translate into GY.

6. Implications

6.1 Theoretical implications

This research yields three principal theoretical advancements. First, it establishes a conceptual framework elucidating the PGIL, EK and GY mediation pathway, thereby expanding the theoretical architecture of sustainable leadership studies through its operationalization of GIL constructs. This model advances discourse on GIL by formalizing mechanisms specific to academic environments. Second, the study empirically validates PGIL's direct positive impact on collegiate GY, extending prior organizational findings on green leadership's creative outcomes (Bhutto *et al.*, 2021; Liu, 2024) to pedagogical contexts. This substantiation confirms the transcontextual applicability of green leadership theories while delineating their unique manifestations in higher education ecosystems. Third, the identification of EK's partial mediation operationalizes the Componential Theory of Creativity's environmental dimension (Amabile & Mueller, 2008), providing empirical evidence for knowledge acquisition as a critical mediator between leadership perceptions and sustainability innovation. This tripartite contribution collectively bridges leadership theories with creative processes in environmental education research.

6.2 Practical Implications

This study proposes two strategic imperatives for higher education institutions. First, academic administrators should prioritize the cultivation of instructors demonstrating GIL competencies through institutionalized selection criteria emphasizing environmental stewardship and pedagogical innovation. Systematic development

programs should be implemented, incorporating sustainability-focused training modules that equip instructors with evidence-based strategies for fostering inclusive, eco-conscious learning environments. Such initiatives align with empirical evidence linking leadership development to enhanced green creativity outcomes (Bhutto *et al.*, 2021; Liu, 2024).

Second, curricular reforms should structurally embed sustainability principles through following approaches: Interdisciplinary integration of environmental case studies and problem-based learning frameworks across disciplines; Establishment of institutional support systems for student-driven sustainability innovation projects; and strategic deployment of environmental exemplars through guest lectures and documentary-based learning modules (e.g., BBC Earth programming). This tripartite approach leverages cognitive, behavioral, and affective learning dimensions to simultaneously elevate EK acquisition and stimulate green creative engagement, thereby operationalizing the CTC's environmental application (Amabile & Mueller, 2008).

7. Limitations and Future Research

This research acknowledges three principal limitations that warrant scholarly attention. First, the cross-sectional data design fundamentally constrains causal interpretation between PGIL, EK, and GY variables. Subsequent investigations should employ longitudinal or experimental methodologies to establish temporal precedence and directional relationships. Second, the exclusive sampling from Hebei Province's higher education institutions limits ecological validity, as cultural and institutional particularities might influence observed effects. Future studies should validate the framework across diverse geographical regions and educational systems, including vocational colleges and transnational comparative analyses. Third, the exclusive focus on EK as a mediating mechanism overlooks potential moderators (e.g., personal environmental values) or alternative mediators (e.g., green self-efficacy) that might refine the PGIL-GY relationship. Expanding the theoretical model to incorporate organizational climate variables or regulatory institutional factors could yield a more nuanced understanding of sustainability creativity dynamics.

Conflict of Interest Statement

The authors declare that the research was conducted without any commercial or financial relationships that could be interpreted as potential conflicts of interest.

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