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Green Learning through Spatial Experience: A Systematic Review of Cultural Awareness of Architectural Heritage

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ABSTRACT

This study presents a systematic review that explores the contribution of green learning, through spatial experience, to the promotion of cultural awareness of architectural heritage. Although green learning is often defined in literature in terms of environmental literacy and ecological performance, this study redefines green learning as a comprehensive educational strategy that incorporates cultural sustainability, place-based learning, and affective learning in the heritage environment. A systematic search of large academic databases (covering the period between 2010 and 2025) was used to select 72 empirical studies, whose data were qualitatively coded using thematic codes in the MAXQDA 24 software. The deductive coding framework was used on three analytical axes: green learning orientations, spatial pedagogical strategies, and sustainability awareness outcomes with respect to heritage. Dominating patterns and conceptual gaps across areas of research were identified through the use of comparative tools. The results show that there is a significant differentiation in the framings of sustainability. Green learning studies are focused on environmental aspects, but research based on place-based learning, architecture education, and heritage backgrounds is more forward-looking, incorporating cultural sustainability, identity, and sense of place as major avenues to sustainable awareness. When the cultural heritage is the central learning medium, spatially-based learning activities contribute not only to cognition but also to emotional attachment as well as behavioral involvement. This review concludes that green learning by spatial experience presents an integrative framework for developing multidimensional sustainability learning in architectural education and recommends the need to explicitly incorporate cultural sustainability in green learning paradigms.

Keywords: Architectural heritage, Cultural awareness, Green learning, MAXQDA software, Spatial experience.

1. INTRODUCTION

With contemporary global pressures, including climate change, cultural erosion, and rising urban homogenization, education systems are being re-aligned with the concept of

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sustainability in a manner that is not limited to ecological performance only. Although environmental awareness continues to play a key role in sustainable development, there is a growing academic discussion to incorporate cultural, social, and spatial aspects as equally important to meaningful and long-term sustainability learning **(Sterling, 2010; Rieckmann and Gardiner, 2017)**. Sustainability, in a broader sense, is something that is not just environmentally literate but also regarding identity, heritage continuity, and place-based meaning. Green learning has become a prominent educational paradigm within the broader view, but it has been frequently approached through the prism of the environment and technology **(Wals and Benavot, 2017)**. Consequently, the cultural sources of sustainability, especially those of heritage, memory, and place identity, are not well-defined in green learning models **(Soini and Birkeland, 2014)**. However, nowadays educational studies suggest the redefinition of sustainability learning, in particular in fields like architecture, where cultural background and spatial experience are constructive determinants of career-level learning **(Salama, 2015)**. This has prompted increased interest in more education methods that can re-link sustainability learning to lived experience, context, and place. Place-based education provides an effective way to respond to this challenge, especially when it is placed in architectural heritage settings. Place-based learning supports students to access knowledge by means of multifaceted perception, emotional appeal, and contextual interpretation **(Gruenewald, 2003; Sobel, 2004; Paniagua and Istance, 2018)**. To architecture students, on-the-ground experience -with historic spaces such as walking, sketching, studying materiality, and telling spatial histories- can transform passive reception of learning into active cultural awareness and spatial cognition **(Norberg-Schulz, 1980; Crinson, 2005)**. These experiences place heritage not as a thing to be studied, but as a means of experience, where values surrounding sustainability are thus practiced.

There is a growing focus in recent research on the idea that learning space is mediated by cognitive and perceptual processes as opposed to the influence of physical form alone. Spatial experience is an interpretive process in which attention, memory, and prior knowledge influence the process of constructing and storing meaning **(Al-Alwan et al., 2022)**. In this view, the learning result is a cumulative process that develops over time by repeating, moving, and interacting with the space, placing experience as the key element of meaningful and lasting learning processes **(Fadhil, 2015; Fadhil and Al-Zuhairi, 2021)**. Learning engagement, in its turn, is perceived as an interactive and affective process conditioned by the features of spatial environments. Studies have shown that such spatial qualities as openness, visual connectivity, and organizational clarity play a vital role in determining attention, participation, and motivation in learners and minimizing cases of disengagement and cognitive burnout **(Al-Muqaram and Al-Amara, 2017)**. These results indicate that learning is not only a product of what is taught, but also the elements of space, in which participation and interaction take place **(Albeag and Al-Bazzaz, 2025)**.

Moreover, place-based education, heritage pedagogy, and green learning are often emerging as separate areas of interest, and there is still no discernible synthesis investigating the intersection of the three areas in practice. The current literature often discusses environmental sustainability, spatial experience, or heritage awareness separately, and there is a lack of opportunities to see how cultural sustainability can be used as a fundamental mechanism in the process of sustainability-focused learning. In addition, a comparatively small number of studies provide systematic analytical frameworks that could be used to assess the effect of spatially and culturally embedded learning experiences in

influencing cognitive, emotional, and behavioral engagement with heritage environments by students.

In this wider context of experiential and spatial learning, modern academic literature also conceptualizes cultural sustainability as a perceptual and experience-based phenomenon, but not a material or symbolic conservation initiative. The continuity, meaning, and identity are maintained by the lived spatial experience, social, and narrative engagement, which places culture in the role of an active mediator between perception, values, and behavior **(Al-Shami and Al-Alwan, 2023)**. In the context of learning processes, the sense of belonging becomes an essential requirement that helps in providing psychological comfort, attention, and willingness to learn **(Al-Khuzaee and Al-Alwan, 2008)**. In line with this gap, this systematic review explores the conceptualization and use of the convergence of green learning, spatial experience, and architectural heritage education in the context of recent scholarly work. Through synthesizing literature on research in the fields of architecture, heritage, and sustainability education, the review aims to determine prevailing thematic trends, expose conceptual asymmetries, and explain the place of cultural sustainability in the learning processes. In this way, it will seek to add insight into the potential of place-responsive learning settings that are culturally embedded to foster multidimensional sustainability outcomes, especially in architectural and design education, which is a key focus of Sustainable Development Goal SDG 4.7 (Education for sustainable development and global citizenship), under which promotion of culture, cultural heritage, and identity contribute to sustainable development **(UNESCO, 2018)**.

2. THE RESEARCH QUESTIONS

This systematic review aims to investigate the conceptualization and implementation of green learning in the context of spatial experience in architectural heritage and place-based learning environments, with special reference to its cultural aspect. Going beyond green learning as an environmentally oriented interpretation, the review explores the role of heritage, place identity, and spatial participation in sustainability-oriented learning. In particular, the systematic review examines how spatially grounded learning techniques, including place-based, experience-oriented, and culturally imprinted techniques, can help to form heritage-related knowledge on cognitive, emotional, and behavioral levels. In general, the review aims at creating a conceptual bridge between green learning, spatial pedagogy, and architectural heritage education. It seeks to promote a more comprehensive understanding of education for sustainable development, particularly within the context of heritage and architectural learning. **Fig. 1** presents the conceptual relationships between green learning, spatial experience, and cultural awareness that guide this review.

To fulfil the purpose of the given systematic and conceptual review, the research is informed by five interconnected research questions that explore how green learning is framed and implemented through the prism of space and cultural aspects in educational literature, with particular attention to the context of architectural, heritage-driven, and place-oriented settings. Instead of asking these questions as separate questions, they serve as analytical prisms of understanding the prevailing patterns, conceptual priorities, and deficits in sustainability-focused education.

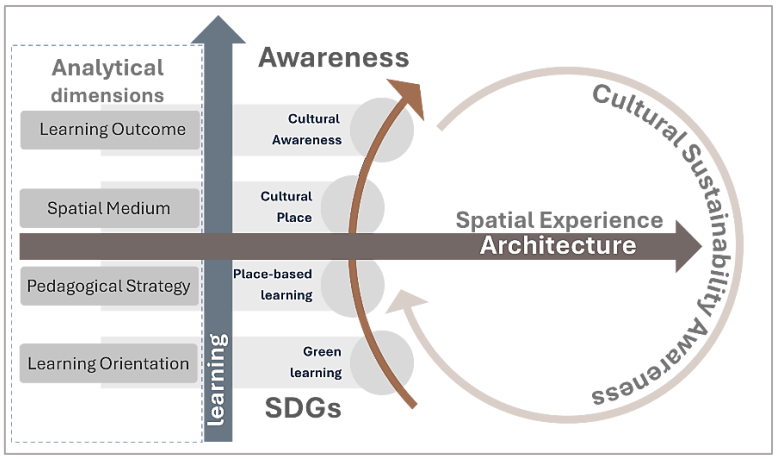


Figure 1. Conceptual framework linking green learning and cultural awareness through spatial experience.

The research questions that will guide the review are:

Research Question 1: How is green learning defined in current educational literature, and to what extent does it encompass cultural and heritage aspects in addition to environmental sustainability?

Research Question 2: What spatial and place-based pedagogical methodologies are utilized to facilitate sustainability education in architectural, heritage, and place-oriented educational contexts?

Research Question 3: How are learning outcomes associated with sustainability and heritage depicted across cognitive, affective, and behavioral dimensions, particularly regarding cultural awareness?

Research Question 4: How do interdisciplinary or integrative educational methodologies seek to link environmental and cultural viewpoints within sustainability-focused learning?

Research Question 5: In architectural and design education, how does interaction with history and spatial experience affect students' reflective practice, creativity, and sustainability-focused design thinking?

These study questions collectively create a cohesive analytical framework that facilitates a holistic understanding of sustainable learning and directs the thematic synthesis in the results section, see **Fig. 2**. This systematic review analyzes research articles addressing the relationship between green learning, spatial experience, and knowledge of cultural or architectural heritage in educational settings.

The review incorporates peer-reviewed literature published in the years 2010-2025 in the fields of architecture, heritage studies, education, and sustainability. These chosen articles were published in internationally indexed journals, mostly in Q1 and Q2 quartile articles, with preference being given to open publications to enhance transparency, accessibility, and uniformity in the analytical procedure. The review concentrates on both empirical qualitative and mixed-method research since these methods are most appropriate in the process of capturing cultural meaning, spatial experience, and the affective aspect of learning. In the academic environment, both formal (e.g., architectural education, heritage education) and non-formal (e.g., heritage site projects, community-based education) are also considered educational initiatives that include a visible pedagogical purpose and learning outcomes. There are a number of constraints that should be noted. The conceptual interpretation gives more priority to the culturally embedded and heritage-based learning,

which can affect thematic emphasis. Moreover, all theoretical studies that lacked empirical evidence in learning were disqualified. Although the review is based on international literature, its interpretation is informed by the sensitivity to the contexts with heritage, possibly influencing the analytical viewpoint, but with a comparative approach.

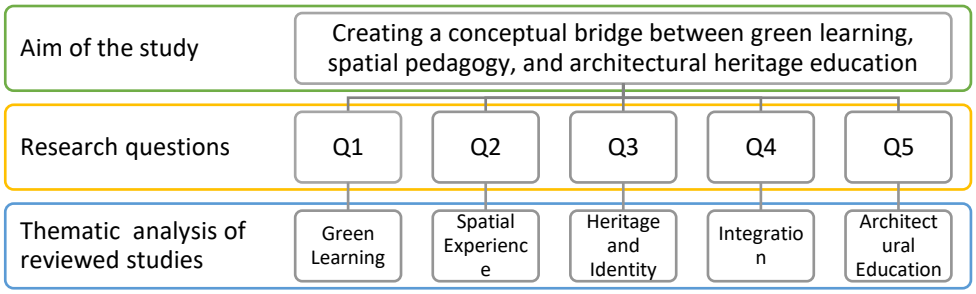


Figure 2. Relationship between review aim, questions, and thematic analysis

3. REVIEW METHOD

The current study adopts a Systematic Qualitative Review method to explore the conceptualization of green learning and its implementation in terms of spatial experience and culturally-located educational experiences, specifically in terms of architectural and heritage-related learning settings, as a systematic method of literature review **(Snyder, 2019)**. The review will provide the synthesis of qualitative evidence through conceptual patterns, thematic orientations, and gaps in analysis, instead of quantifying the effects or measuring the efficacy of the interventions, based on a qualitative synthesis approach **(Thomas and Harden, 2008)**. The systematic organization, coding, and comparative thematic analysis were supported with the help of qualitative data analysis software (MAXQDA 24).

3.1 Review Design

A systematic search of literature has been performed in the most significant scholarly databases presented by Scopus, Web of Science, and Google Scholar. Three main conceptual areas that determined the search strategy included green learning, spatial experience, and cultural or architectural heritage awareness.

Since the research that explicitly combines all three domains is still limited and spread throughout different fields, the search strategy was increased iteratively, within the frame of a systematic search procedure **(Booth et al., 2016)**, through pairwise combinations of the domains (e.g., green learning and spatial experience; spatial experience and heritage education; green learning and cultural sustainability). In this way, the studies that addressed at least two of the conceptual axes were identified and then assessed as relevant to the third one during screening and analysis. This plan provided broad coverage of an interdisciplinary area of research, emerging without any loss of conceptual orientation.

3.2 Study Selection

The selection of the study was conducted in ways that were systematic and predetermined, following a systematic review procedure **(Booth et al., 2016)**, to include or exclude a study. Included studies had to be empirical (qualitative, quantitative, or mixed-method), be published within the years 2010 to 2025, and be located within education settings of

architecture, heritage, design, or place-based learning. Studies that explicitly incorporated the spatial, experiential, or site-based learning elements and presented learning outcomes (in the form of awareness, engagement, attitudes, or skills) were also included. Only purely theoretical publications and non-English studies were excluded. Notably, those studies that had their green learning framed in terms of environmental or ecological were not ruled out but rather included in the comparative analysis that was to be done to enable the determination of conceptual imbalances in literature. The final sample is 72 peer-reviewed articles, published in internationally indexed journals, mostly listed in the first and second quartiles, and open-access articles were preferred to provide transparency and the ability to access the full-text of the research.

3.3 Data Organization and Coding Strategy

All of the chosen studies (n = 72) were imported into MAXQDA 24 and were arranged in a single document group. The five research questions (RQ1-RQ5) were conceptualized as analytical Sets, based on the fact that a single study could be analyzed from multiple perspectives without counting documents twice. The reviewed studies are presented in **Table 1** according to the five research questions guiding this systematic qualitative review.

Table 1. Reviewed the distribution of studies among the research questions

Filed	Research papers
Q1 Green Learning	**(Zsóka et al., 2013; Dagiliūtė et al., 2018; Boca and Saraçli, 2019; Hay and Eagle, 2020; Azhar et al., 2022; Collado et al., 2022; Leiva-Brondo et al., 2022; Prieto-Sandoval et al., 2022; Wang et al., 2022a; Fernández et al., 2023; Ma et al., 2023; Mohammadi et al., 2023; Angelaki et al., 2024; Chen et al., 2024; Douglas et al., 2024a; Li et al., 2024; Taboada-González and Aguilar-Virgen, 2024; Al Husban, 2025; Bustamante-Mora et al., 2025; Zhang and Cao, 2025)**
Q2 Spatial Experience	**(Deslauriers et al., 2019; Barlow and Brown, 2020; Yusof et al., 2020; Guo et al., 2021; 2025; Hartikainen et al., 2021; Kong, 2021; Riffert et al., 2021; Iqbal et al., 2022; Umar and Ko, 2022; David and Weinstein, 2023; Gonzalez, 2023; Khan et al., 2023; Venn et al., 2023; Chang et al., 2024; Duan, 2024; Ma et al., 2024; Nimri et al., 2024; Molendijk et al., 2025)**
Q3 Heritage & Identity	**(Trabajo-Rite and Cuenca-López, 2020; Dabamona et al., 2021; López-Fernández et al., 2021; Echavarria et al., 2022; Grimshaw and Mates, 2022; Spennemann, 2022; Xu, 2023; Yan and Li, 2023; Chireac and Peris, 2024; Lin et al., 2024; Orphanidou et al., 2024; Souropetsis and Kyza, 2025)**
Q4 Integration	**(Howlett et al., 2016; Zelenika et al., 2018; Braßler and Sprenger, 2021; Chen et al., 2022; Oe et al., 2022; Wang et al., 2022b; Gonzalez, 2023; Douglas et al., 2024b; Algurén, 2025)**
Q5 Architectural Education	**(Helmy, 2018; Djabarouti and O'Flaherty, 2019; Clarke et al., 2020; Curto et al., 2021; Trajković et al., 2021; Đorđević et al., 2022; Milic et al., 2022; Dipasquale et al., 2024; López and González, 2024; Iqbal and Shafique, 2025; Quattrini et al., 2025; Rodi and Stachura, 2025; Yunxuan et al., 2025)**

A preliminary familiarization step was a close reading of all studies, as a step in the qualitative content analysis process **(Kuckartz, 2014)**, to determine general thematic directions. External to this reading, three broad coding areas were created to make the analysis structure. Since the reviewed studies applied various terminologies to define

sustainability-oriented learning, the original coding terms were used as the words used in the literature. Through the interpretive synthesis phase, these coding references were conceptually incorporated into analytic groups that reflected the green learning orientations, spatial pedagogical strategies, and outcomes of sustainability awareness.

The AI-assisted coding capability of the version of MAXQDA (24.11.0) was used in the exploratory stage to process the large qualitative dataset systematically, which resulted in initial coding proposals and the generation of an initial pool of 3,159 coded segments. These recommendations were taken as initial analytic support.

All the codes and segments were then revised, refined, and again checked and validated manually by the researcher. With the help of iterative reading and interpretive analysis, codes were rearranged as hierarchic structures with first and second level subcodes and weakly represented or conceptually mismatched codes were eliminated. This refinement process led to an ultimate set of 1,580 analytically meaningful coded segments. In practical terms, every reviewed article was imported into MAXQDA as an independent document. Passages relating to green learning, spatial experience, heritage education, and sustainability outcomes were identified and marked as coded segments. These segments were then assigned thematic codes and arranged into hierarchical groups. The resulting coded dataset enabled the comparison of the themes across the research questions and generated the code matrix and relational coding structures. (see **Fig. 3**)

Code System	RQ1–Green Learning	RQ2–Spatial Experience	RQ3–Heritage & Identity	RQ4–Integration	RQ5–Architectural Education	...
Sustainable Development Goals	183	145	212	110	277	927
Place-Based Learning Strategies	171	170	240	106	276	963
Sustainability Awareness Outcomes	585	73	183	163	265	1269
SUM	939	388	635	379	818	3159

a. Exploratory phase

Code System	RQ1–Green Learning	RQ2–Spatial Experience	RQ3–Heritage & Identity	RQ4–Integration	RQ5–Architectural Education	SUM
Sustainable Development Goals (SDGs)	138	75	86	60	121	480
Place-Based Learning Strategies	113	105	99	69	147	533
Sustainability Awareness Outcomes	159	95	90	78	145	567
SUM	410	275	275	207	413	1580

b. Interpretive phase

Figure 3. Code matrix comparison between the research questions of the exploratory and interpretive phases (Author's analysis using MAXQDA)

The possibility of coding was defined by the conceptual presence and analytical relevance, but not by the repetition of the text. The counts of the codes were counted in a document in which the concept was well expressed and substantially relevant, irrespective of where the concept was found, and the number of times this was encountered in the text. Simultaneous coding was used, where one passage had a variety of meanings. The relationship between the codes and the sub-codes is illustrated in **Fig. 4**.

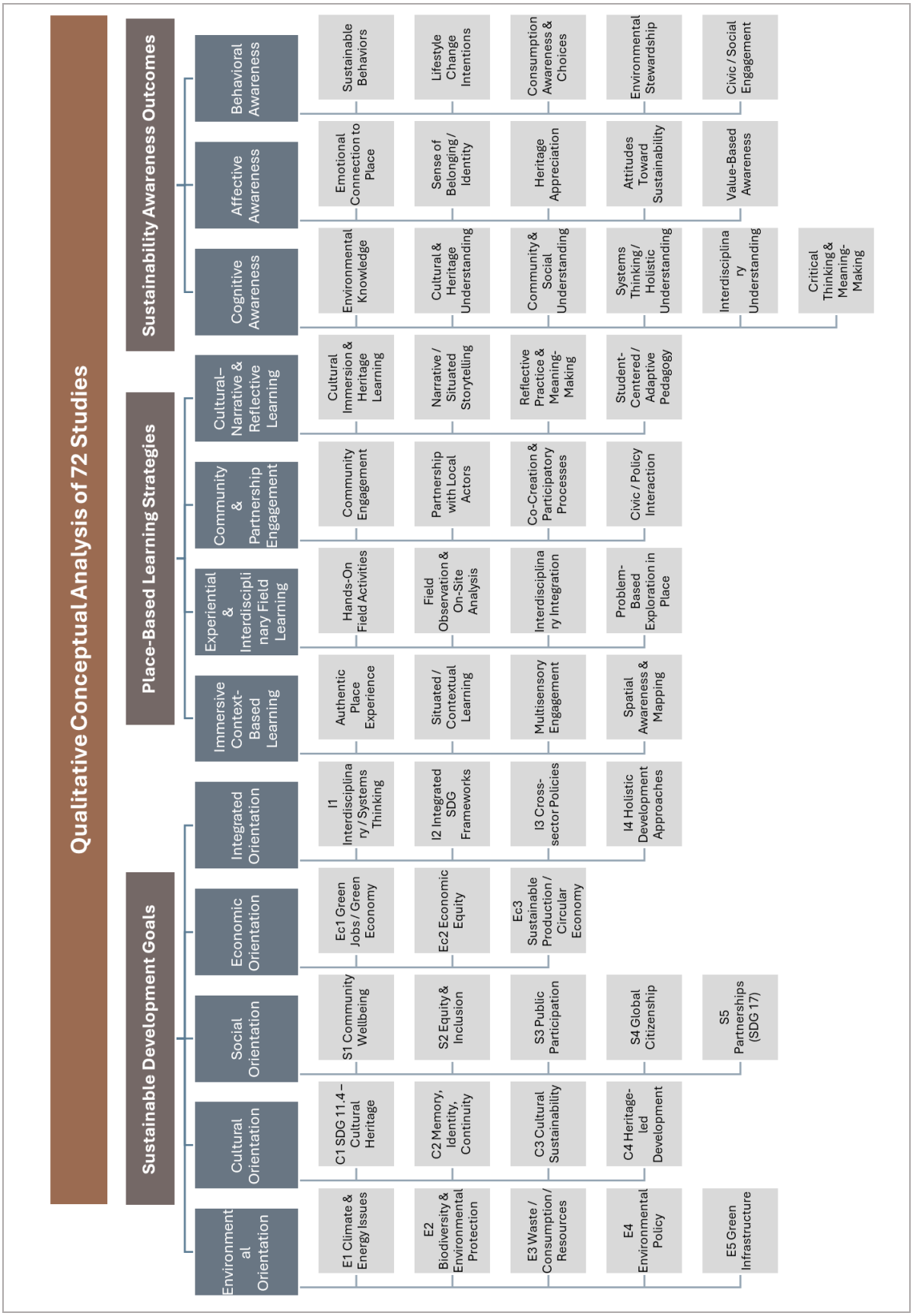


Figure 4. Relational structure of sub-codes as identified in the qualitative coding (Author's elaboration based on MAXQDA)

3.4 Analytical Tools and Synthesis Approach

MAXQDA software was used to perform thematic analysis and synthesis to identify the codes through the use of the Code Matrix Browser, Code Co-occurrence Models, and Summary Grids. Those tools allowed them to compare thematically distributed data, overlaps, and contrasts systematically across research questions and coding domains.

Research that was largely oriented towards the environment was used to feed the comparative pattern analysis, and research that was more oriented to cultural, spatial, and heritage-based learning fed the conceptual synthesis, which was consistent with the essence of the review. This difference aided the establishment of an evident knowledge gap between green learning as an environmentally framed concept and education practices that are culturally based.

4. THEMATIC FINDINGS

4.1 Overview of the Dataset and Coding Output

The analysis of the review is based on 72 peer-reviewed studies. The resulting product of the coding was 1,580 analytically relevant coded segments, which were presented under three major areas of analysis: sustainability orientations, spatial and place-based pedagogical strategies, and learning and awareness outcomes.

There were 480 sustainability and SDG orientations, 533 spatial pedagogical strategies, and 567 learning and awareness outcomes segments that were coded. It is the basis of these distributions that offers the quantitative basis of the thematic patterns and comparative analyses that follow. The hierarchical structure of identified codes is presented in **Fig. 5**.

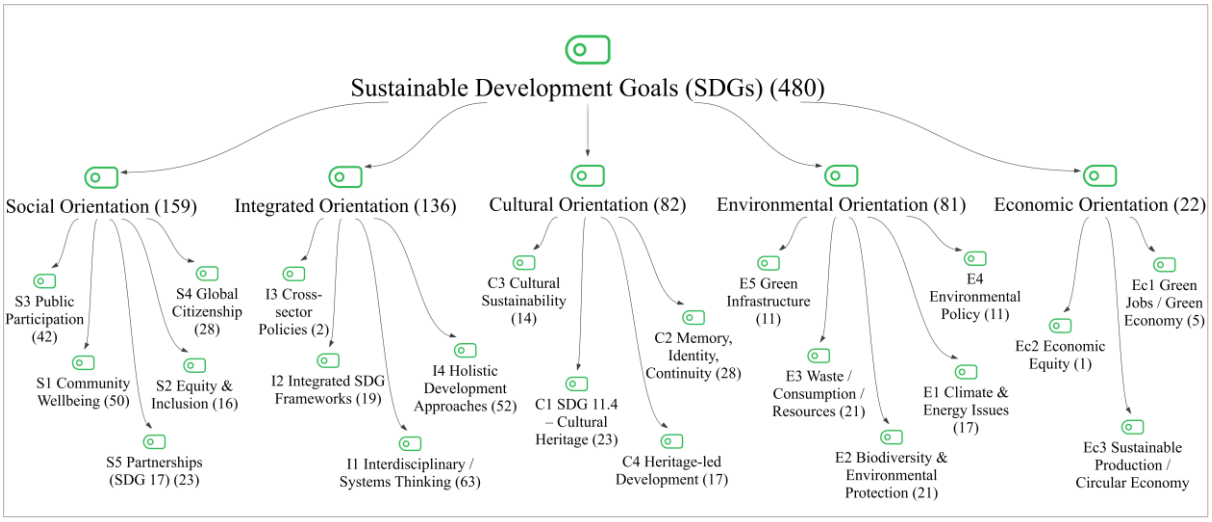
The reporting of coding results is done in terms of conceptual presence at the study level, such that the findings are made to capture thematic focus within the entire literature and not duplication in the single publications.

4.2 Sustainability Orientations in Green, Spatial, and Architectural Education

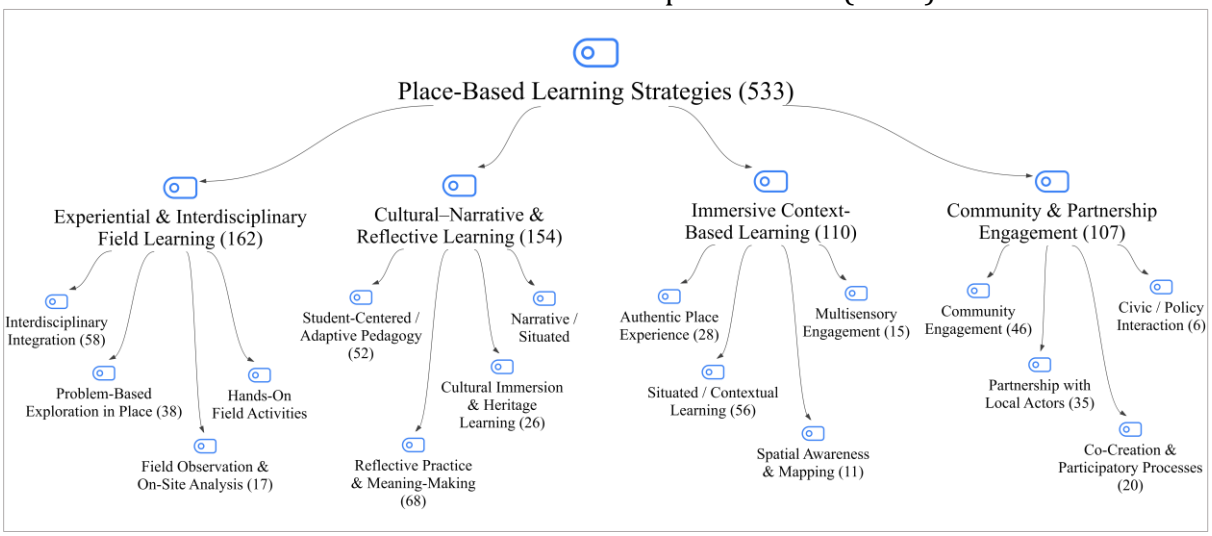
The comparison of sustainability orientations in the literature reviewed indicates a significant difference between the ways sustainability is conceptualized in green learning, spatial experience, and architectural education. According to the output of the MAXQDA coding, the total amount of coded segments was 480, and related to the sustainability and SDG-related orientations, which could be categorized into 5 dimensions, namely: environmental, cultural, social, economic, and integrated.

On the aggregate level, the cultural orientation (82 segments) is almost as prevalent as the environmental orientation (81 segments), whereas social orientation (159 segments) and integrated approaches (136 segments) are more dominant in general. Conversely, economic sustainability is peripheral as it captures 22 segments in totality of the data. Such dispersion indicates the occurrence of social and cultural sustainability orientations and ecological issues in education-related research that address place and heritage.

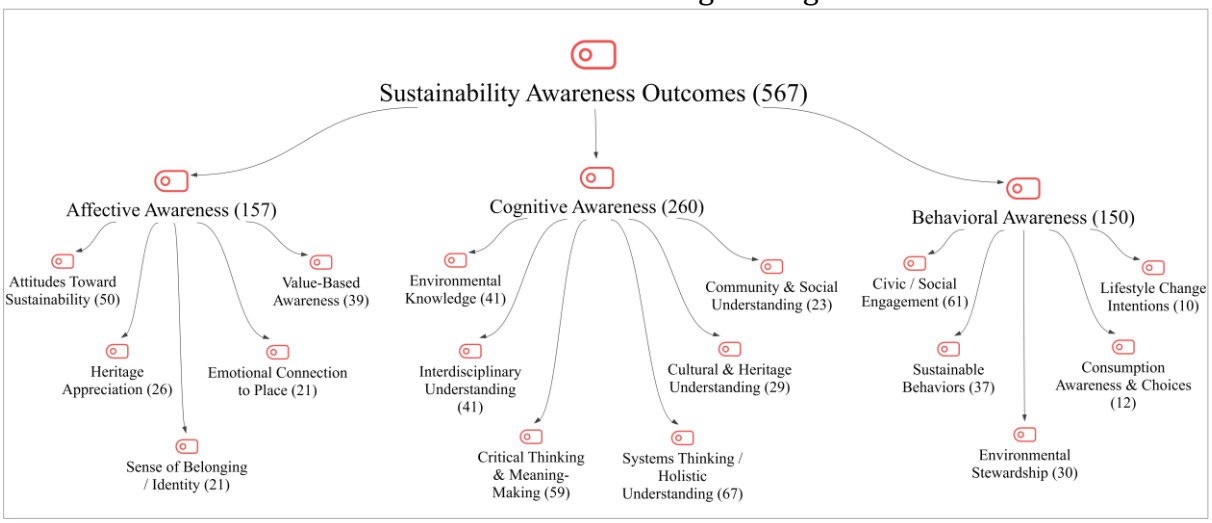
However, when comparing research questions, a cross-comparative analysis indicates that divergence in focus is evident in **Fig. 6**.



a. Sustainable Development Goals (SDGs)



b. Place-Based Learning Strategies



C. Sustainability Awareness Outcomes

Figure 5. Hierarchical level of codes and sub-codes of the qualitative synthesis (a, b, c), (Author's analysis using MAXQDA)

Research set within the direct perspective of green learning (RQ1) gives more emphasis on environmental and social orientations (49 and 42 segments, respectively), and there is no cultural orientation reported. In comparison, the relevance of heritage and identity (RQ3) and architectural education (RQ5) in studies shows that these two categories are highly oriented to culture (34 and 43 segments), overcoming the importance of the environment in each of them. Spatial-experience (RQ2) and integrative (RQ4) studies are in an intermediate area, whereby cultural dimensions can also be found, but secondarily to social or integrative frames.

Code System	RQ1–Green Learning	RQ2–Spatial Experience	RQ3–Heritage & Identity	RQ4–Integration	RQ5–Architectural Education	SUM
Sustainable Development Goals (SDGs)						0
Environmental Orientation						0
E1 Climate & Energy Issues	11			2	4	17
E2 Biodiversity & Environmental Protection	8		4	7	2	21
E3 Waste / Consumption / Resources	13	1		4	3	21
E4 Environmental Policy	10			1		11
E5 Green Infrastructure	7	2	1		1	11
Cultural Orientation						0
C1 SDG 11.4 – Cultural Heritage		1	10		12	23
C2 Memory, Identity, Continuity		2	12	1	13	28
C3 Cultural Sustainability			7		7	14
C4 Heritage-led Development			5	1	11	17
Social Orientation						0
S1 Community Wellbeing	9	14	8	6	13	50
S2 Equity & Inclusion	3	7	3	2	1	16
S3 Public Participation	8	13	7	4	10	42
S4 Global Citizenship	14	2	5	5	2	28
S5 Partnerships (SDG 17)	8	3	1	3	8	23
Economic Orientation						0
Ec1 Green Jobs / Green Economy	1		2		2	5
Ec2 Economic Equity		1				1
Ec3 Sustainable Production / Circular Economy	7		1	3	5	16
Integrated Orientation						0
I1 Interdisciplinary / Systems Thinking	16	15	9	9	14	63
I2 Integrated SDG Frameworks	11		2	4	2	19
I3 Cross-sector Policies	1				1	2
I4 Holistic Development Approaches	11	14	9	8	10	52
SUM	138	75	86	60	121	480

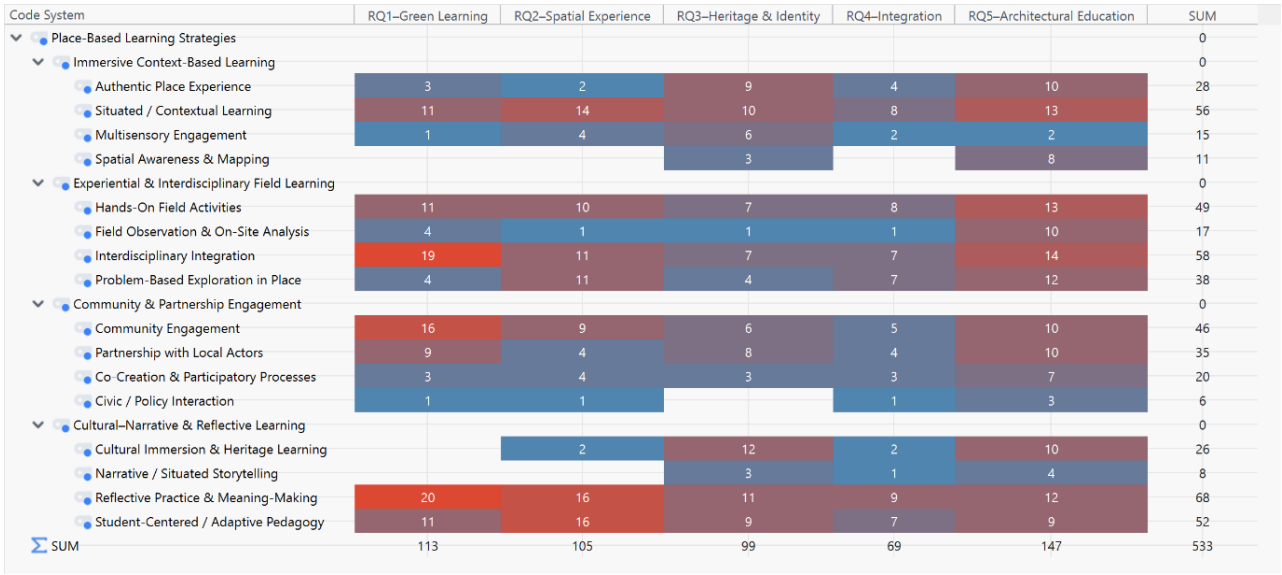
Figure 6. Distribution of sustainability orientations on research questions (Author's analysis using MAXQDA)

In combination, these trends demonstrate that although the notion of cultural sustainability is much more evident in the research on heritage and architecture, it is mostly missing in the field studies that explicitly use the term and frames of green learning. This can be seen as a distinct empirical difference between the conceptualization of sustainability in various spheres of education and forms the foundation of defining the cultural breach that forms the focus of further analyses.

4.3 Spatial Pedagogical Strategies and Associated Learning Outcomes

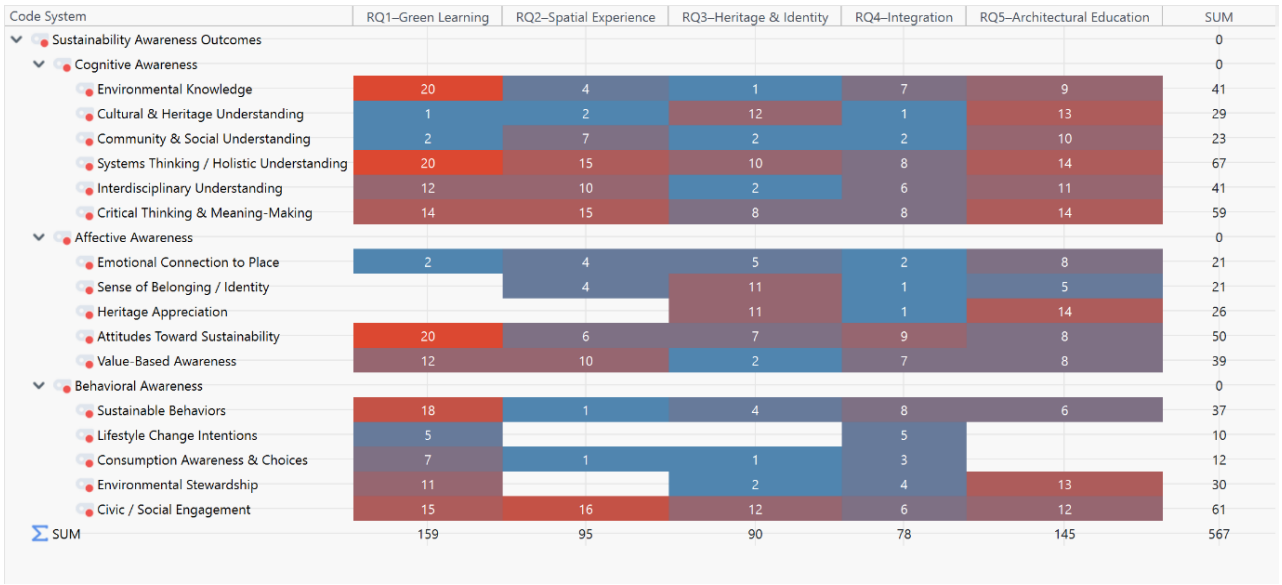
The spatial and place-based pedagogical strategies were analyzed with 533 of the coded segments divided into four dominant clusters of interest: experiential and interdisciplinary field learning (162 segments), cultural-narrative and reflective practices (154 segments), immersive context-based learning (110 segments), and community and partnership engagement (107 segments). **Fig. 7** demonstrates that spatial and place-based pedagogical strategies are structured mostly around clusters of interest such as experiential, reflective, and context-based learning and are more or less emphasized in the various. Simultaneously, sustainability awareness results were explained by 567 coded segments, which were related

to cognitive (260), affective (157), and behavioral (150) dimensions. It is observed that this distribution is characterized by a high cognitive component, followed by the affective component, and the behavioral outcome is the least common. As indicated in **Fig. 8**, the results of cognitive awareness are the most commonly used in all of the reviewed studies, though affective and behavioral outcomes are more evident in heritage-based and place-based learning.



Code System	RQ1–Green Learning	RQ2–Spatial Experience	RQ3–Heritage & Identity	RQ4–Integration	RQ5–Architectural Education	SUM
Place-Based Learning Strategies						0
Immersive Context-Based Learning						0
Authentic Place Experience	3	2	9	4	10	28
Situated / Contextual Learning	11	14	10	8	13	56
Multisensory Engagement	1	4	6	2	2	15
Spatial Awareness & Mapping			3		8	11
Experiential & Interdisciplinary Field Learning						0
Hands-On Field Activities	11	10	7	8	13	49
Field Observation & On-Site Analysis	4	1	1	1	10	17
Interdisciplinary Integration	19	11	7	7	14	58
Problem-Based Exploration in Place	4	11	4	7	12	38
Community & Partnership Engagement						0
Community Engagement	16	9	6	5	10	46
Partnership with Local Actors	9	4	8	4	10	35
Co-Creation & Participatory Processes	3	4	3	3	7	20
Civic / Policy Interaction	1	1		1	3	6
Cultural–Narrative & Reflective Learning						0
Cultural Immersion & Heritage Learning		2	12	2	10	26
Narrative / Situated Storytelling			3	1	4	8
Reflective Practice & Meaning-Making	20	16	11	9	12	68
Student-Centered / Adaptive Pedagogy	11	16	9	7	9	52
SUM	113	105	99	69	147	533

Figure 7. Distribution of spatial and place-based pedagogical strategy clusters across Research Questions (Author's analysis using MAXQDA)



Code System	RQ1–Green Learning	RQ2–Spatial Experience	RQ3–Heritage & Identity	RQ4–Integration	RQ5–Architectural Education	SUM
Sustainability Awareness Outcomes						0
Cognitive Awareness						0
Environmental Knowledge	20	4	1	7	9	41
Cultural & Heritage Understanding	1	2	12	1	13	29
Community & Social Understanding	2	7	2	2	10	23
Systems Thinking / Holistic Understanding	20	15	10	8	14	67
Interdisciplinary Understanding	12	10	2	6	11	41
Critical Thinking & Meaning-Making	14	15	8	8	14	59
Affective Awareness						0
Emotional Connection to Place	2	4	5	2	8	21
Sense of Belonging / Identity		4	11	1	5	21
Heritage Appreciation			11	1	14	26
Attitudes Toward Sustainability	20	6	7	9	8	50
Value-Based Awareness	12	10	2	7	8	39
Behavioral Awareness						0
Sustainable Behaviors	18	1	4	8	6	37
Lifestyle Change Intentions	5			5		10
Consumption Awareness & Choices	7	1	1	3		12
Environmental Stewardship	11		2	4	13	30
Civic / Social Engagement	15	16	12	6	12	61
SUM	159	95	90	78	145	567

Figure 8. Distribution of sustainability awareness outcomes across research questions (Author's analysis using MAXQDA)

Co-occurrence patterns and cross-tabulation additionally shed more light on the relationship between these strategies and learning outcomes. There is a strong and consistently correlated relationship between experiential and immersive strategies in space, i.e., hands-on field work, authentic place experience, and situated learning and cognitive

outcomes, in particular systems thinking, interdisciplinary knowledge, and critical reflection. However, cultural-narrative and reflective approaches, which comprise reflective practice, storytelling, and cultural immersion, are more likely to be accompanied by affective results, like emotional attachment to place, appreciation of heritage, sense of belonging, and value-based awareness, see **Fig. 9**.

The participatory and community-engaged strategies have a more differentiated pattern. Although they overlap in the middle range with cognitive and affective dimensions, their most apparent correlations are with behavioral outcomes, particularly civic and social action, and sustainability-oriented action. But the number of these links differs in the results of the studies, indicating that behavioral change is more context-sensitive and not wholly brought about by spatial exposure.

Codes in the analyzed corpus were tallied in each individual document as per their substantial presence and applicability to the topic covered in the study, and not according to how often they happened within subsections. The fact that it is co-occurring in the same document, in this case between spatial strategies and awareness outcome, implies that spatial experience belongs to the mediating state of different profiles of engagement. In general, the findings indicate that the definition of experiential strategies tends to correlate more with cognitive learning outcomes, cultural-reflective practice leads to the activation of affective awareness, and community-oriented strategies promote emergent responses in behavioral changes. These patterns, which are differentiated and interrelated, substantiate the notion that sustainability learning based on spatial experience is multidimensional and highly conceived by the cultural and reflective organization of place-based education.

4.4 Cross-Comparative Patterns and Key Empirical Trends

The cross-comparative analysis of the reviewed articles determines the existence of three common empirical trends that come forth due to the interrelationships between sustainability orientations, spatial pedagogical strategies, and learning outcomes.

To begin with, the studies that focus on cultural sustainability, especially those in the educational setting, which involve heritage and architecture, are more strongly connected with affective and behavioral learning outcomes than those oriented to environmental sustainability. Cultural themes, like heritage, identity and memory, are often combined with narrative, reflective and community-based strategies and are often connected more with emotional engagement and participatory learning.

Second, place-based and place learning approaches also relate to a larger repertoire of learning outcomes than non-situated or concept-based teaching strategies. Experiential and immersive pedagogies are more well-balanced in their cognitive, affective, and behavioral dimensions, meaning that spatial experience persistently fully attends the various modalities of learning interactions throughout the studies reviewed.

Third, the discussion demonstrates that disciplinary framing is related to various sustainability learning outcomes profiles. Scholars who locate their studies in architectural and design education are more often oriented to predict spatial cognition, situational and critical thinking, and imaginative categorizing, which lead to robust cognitive and philosophical scores. Conversely, articles that focus on heritage education and community-based studies show more frequently emphasize emotional engagement, cultural consciousness, and civic engagement. Collectively, these patterns summarize the key empirical trends apparent in the reviewed literature and give a narrow-focused empirical foundation to the ensuing empirical discussion.

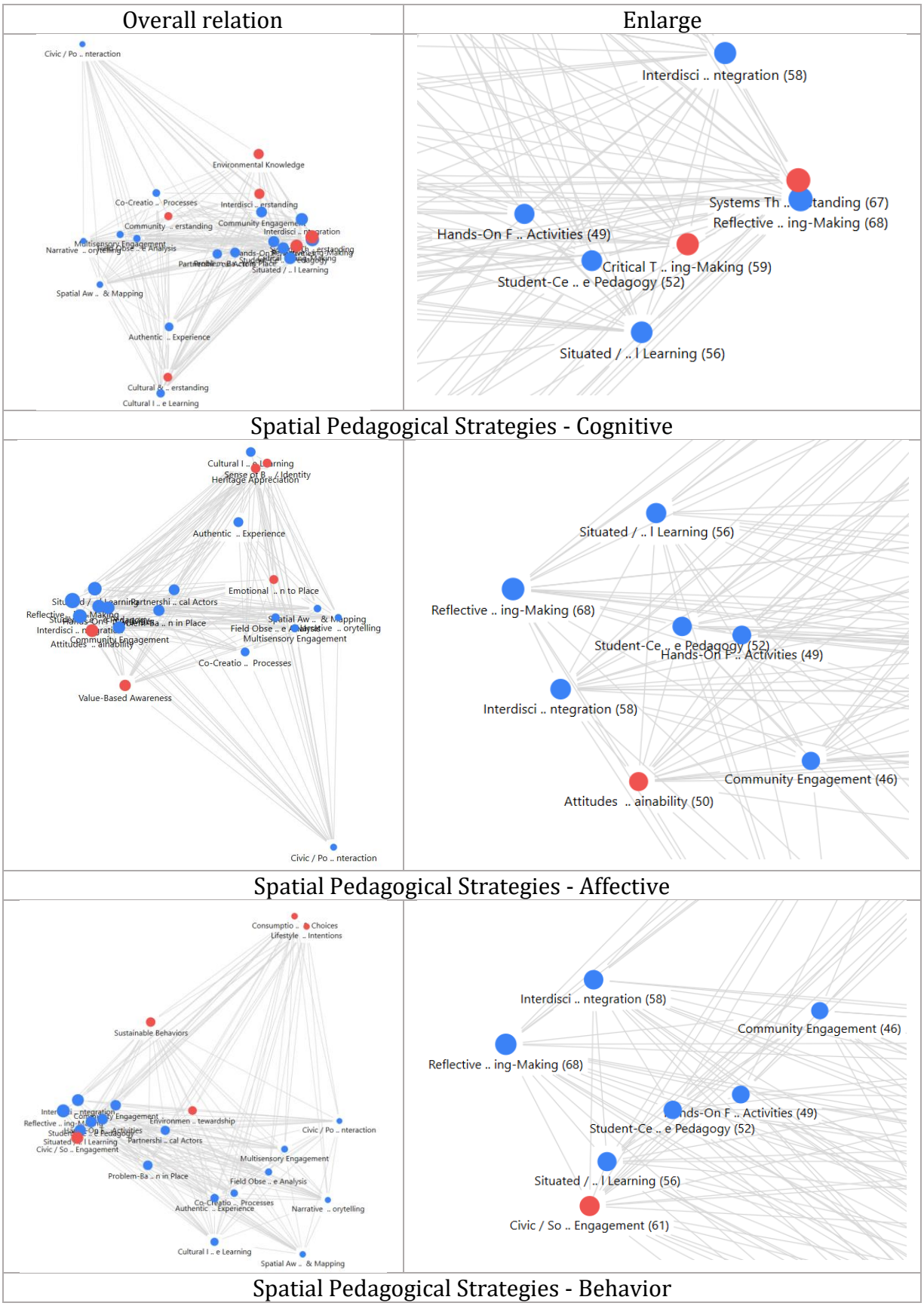


Figure 9. Code co-occurrence between spatial pedagogical strategies and learning outcomes, (Author's analysis using MAXQDA)

5. RESULTS AND DISCUSSION

These empirical patterns taken collectively invite a more specific investigation of the conceptual framework of green learning in the context of educational discussions concerning architecture and heritage. The terms applied to this discussion are the interpretative synthesis of the coding findings, but not the initial terms that came in the exploratory coding findings. By means of the repeated comparisons and the consolidation of ideas, as an aspect of interpretive thematic synthesis **(Thomas and Harden, 2008)**, The various references in the reviewed literature were merged into frames of analysis, which represent the discussion of green learning, spatial pedagogy, and Sustainability awareness outcomes.

5.1 Reframing Green Learning through Cultural Sustainability

The results of this review undercut the dominant way green learning is being framed as being more environmental and technical. Although environmental goals are still core to sustainability education, empirical trends show that in architectural and heritage-based learning mediums, sustainability is mediated more often by cultural meaning, place identity and experience, as stressed in place-based pedagogical models **(Gruenewald, 2003)**. Cultural sustainability is not directly presented as a pillar of green learning models, and it is indirectly brought about by heritage-based pedagogy and spatial learning.

This disconnect indicates a lack of concept in existing discussions of green learning. The cultural dimensions currently influencing the learning outcomes (through memory, identity and responsibility to the place) are taken into the active meaning and shape, but, at the same time, do not possess theorization in the area of sustainability education. In consequence, green learning tends to favor cognitive awareness at the expense of under-valuing the affective and ethical capacities that are key to long-term involvement in architecture. Cultural sustainability as a reframing of green learning is thus more really a conceptual shift in emphasis than an addition, a way to bring sustainability education into close relation with the experiential and place-responsive logic of architectural learning.

5.2 Spatial Experience as a Mediator of Deep Sustainability Learning

It is shown that spatial experience is not a neutral environment of sustainability education, but the mediating condition, related to knowledge acquisition, emotional involvement and behavioral intention in some cases. The more balanced profiles in learning are always accompanied by place-based and immersion strategies, which presuppose the integration of cognitive, affective, and action-aware qualities via their spatial encounter, as emphasized in place-based sustainability education studies **(Gonzalez, 2023)**.

Such a mediating position is useful in understanding the fact that sustainability learning based on real, culturally significant environments is qualitatively different from concept-based or abstract teaching. Embodied interaction, contextual perception and interpretation introduce sustainability as the condition of relation between the past and present, use and value, intervention and consequence to the learners, in line with a place-based pedagogical approach **(Gruenewald, 2003)**. Spatial experience has the potential to organize attention and reflection to sustainability learning beyond informational awareness to personal relevance and responsibility, especially in architectural and heritage education.

5.3 Architectural Implications and Pedagogical Boundaries of Spatial Sustainability Learning

This review suggests that to promote the idea of sustainability in the field of architectural and heritage education, there needs to be a transition towards more place-responsive and interpretive pedagogies that prefigure spatial experience, cultural meaning and reflective practice, as addressed in architectural pedagogical models **(Salama, 2015)**. When it comes to architectural learning, sustainability is most readily fostered in an environment where the students are immersed in real places, and it is in reading about spatial conditions and understanding cultural layers and contemplating the after-effects of a design intervention that they can propose solutions, which have been emphasized in heritage-based architectural education studies **(Clarke et al., 2020)**.

Nonetheless, in the synthesis, a methodological limitation in the literature survey can be identified as well. Throughout most of the literature, the concept of emotional engagement, as well as reflection and awareness, is central, but less literature specifically discusses how spatial experience is applied to architectural reasoning, representation, and design decision-making. Experience with heritage and place-based learning is frequently recorded as an intervention into practice as opposed to an entrenched part of the architectural design process, making it constrained in its explanatory capacity within the logic of disciplines.

In addition, the fact that most of the educational contexts are short-term (isolated studios, workshops, or site-based activities) indicates that the existing studies are capturing snapshots of spatial interactions, but not of long-term architectural learning processes. Despite the fact that these interventions show a powerful impact in the immediate future, their longitudinal sustainability and impact on long-term design thinking is under-researched.

Collectively, these observations signify pedagogical possibilities and epistemological constraints of the contemporary procedures of spatial sustainability education within architecture. They refer to the necessity of further studies that would relate more explicitly cultural and spatial experience to architectural instruments, representational practice and gradual learning processes.

5.4 Toward a Conceptual Model for Enhancing Cultural Awareness through Place-Based Learning

Through the synthesis of the reviewed studies, one of the suggestions proposed in this research is a conceptual model explaining how cultural awareness may be improved through learning experiences in heritage settings. This model incorporates three components that go hand in hand. To begin with, place-based learning strategies would present the pedagogical point of entry through organizing learning as experience and cultural embedded learning. Second, the heritage place is a spatial and affective medium, in which immediate spatial experience generates emotional attachment, belongingness and explanation of cultural significance. Lastly, the outcome of this interaction is the cultural awareness development being a multi-dimensional phenomenon that involves cognitive understanding, emotional attachment and behavioral accountability to heritage. The model defines sustainability as a product of cultural awareness and not a goal, emphasizing the contribution of the place and emotion towards the long-term relationship with the built environment. The model is a synthesized understanding of recurrent trends through scanned literature, and it is designed to inform but not to determine the educational strategies in architectural and heritage

related settings. Generally, the suggested model is a synthesis of the most important findings that gave evidence on the overall nature of learning in association with spatial experience and emotional involvement in reaching the objective of cultural awareness as a means of sustainable development. It provides a theoretical foundation to the conceptual formulation of informing future pedagogy of architecture through the rich background that has been built on architectural history without presupposing a predetermined channel of pedagogy or a predetermined criterion to be followed in their evaluation.

As shown in **Fig. 10**, a systematically generated conceptual model based on the systematic qualitative review presents the ways in which place-based learning strategies trigger the learning process, how heritage places mediate the learning process through the lens of spatial experience and emotional attachment, and how cultural awareness develops as a multidimensional solution to sustainability. The model is more of an interpretive model and not an instructional framework that is prescriptive or tested.

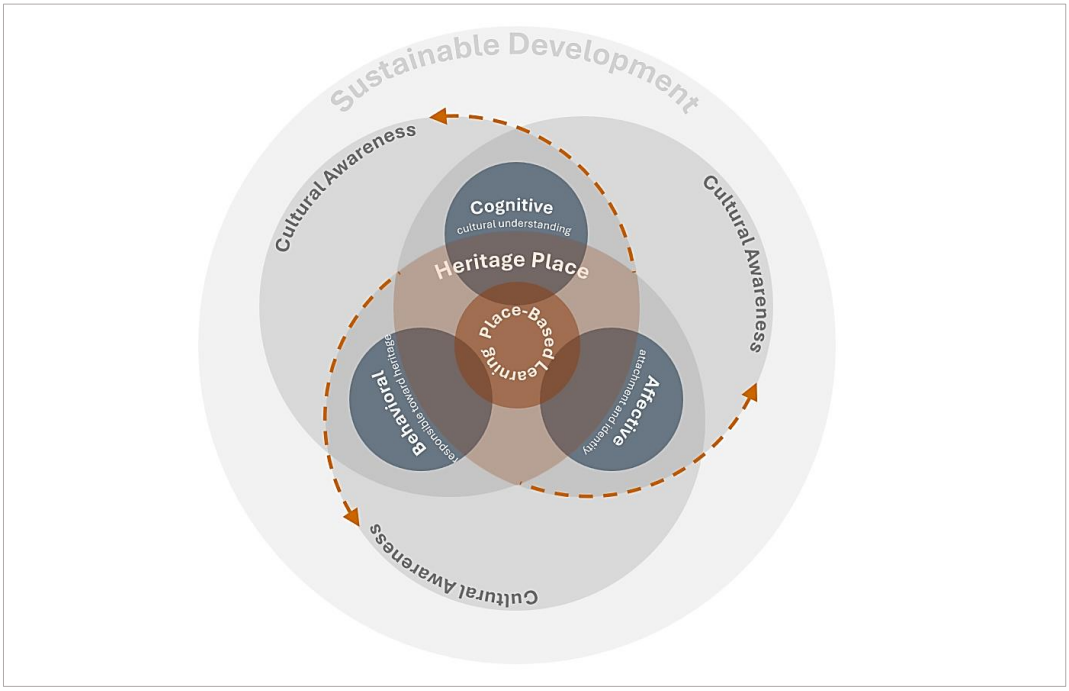


Figure 10. A conceptual model of enhancing cultural awareness through place-based learning

These sub-components that were chosen in every axis of the proposed conceptual model have not been chosen randomly, as they have been formed in a result of a qualitative synthesis of the most recurrent and analytically important subjects that were identified in the analyzed studies. In the learning strategy axis, place-based learning is typified with experiential and culturally bound methodology, and this aspect depicts the common pedagogical elements where learning is placed in context. These factors work in a complementary way, as they describe the structure of learning instead of establishing sequential actions. The heritage place is described as the basic unit of the model, or more to the point the conceptualization of a spatial and affective media which is explained through the means of spatial experience, emotional affiliation and a sense of belonging. These aspects are the layers of relationship where there is immediate spatial contact where emotional reaction occurs thus further identification of place is achieved. This connection is

interpretive in nature and not procedural and focuses on the accrued complexity of engagement that is established through the experience of space.

The cultural awareness axis is used as the measure of learning outcomes that are usually divided into cognitive, affective, and behavioral levels. These dimensions are interdependent levels of awareness with understanding, emotional attachment, and responsibility about heritage reinforcing each other instead of developing in a linear manner. Throughout the model, all the axes illustrate explanatory connections and how strategic pedagogical approaches would engage spatial-affective activity that mediates gain of cultural awareness and facilitate sustainability as a resultant outcome. The model reflects overall patterns in the literature, thus summarizing the patterns into a conceptual framework without suggesting causality or prescriptive use. In addition to the synthesis of the existing literature, this review provides a culturally informed reconstitution of the idea of green learning, putting the spatial experience and heritage interaction as the central sustainability awareness tools instead of the contextual adoptions.

6. CONCLUSIONS

The contribution of this review to the existing debate on sustainability education is to show that spatial experience and cultural meaning play a central role in developing sustainability learning in the context of architecture and heritage. The study identified a critical conceptual imbalance that prevailed in the literature, presented by the neglect of the deep and long-lasting architectural and place-based learning outcomes, as well as identifying cultural sustainability as a central aspect, yet lacking sufficient theoretical grounding. The results show that, concerning heritage and architecture-related contexts, sustainability learning is most successfully elicited by immediate interaction with place whereby the spatial experience mediates the connection between knowledge, emotion and action. In this process, emotional attachment to place, which gets expressed as a sense of belonging and attachment as well as cultural belonging, serves as a major element of cultural sustainability and the means by which learners would internalize sustainability principles beyond cognitive knowledge. This type of affective interaction empowers the learners in their sense of responsibility about the built environment and helps to generate more enduring and value-based learning outputs. Nevertheless, this cultural-emotional aspect is mostly insignificant on the formal green learning models, which still retain a tendency to focus on environmental performance and behavioral efficiency. Consequently, the use of culturally and emotionally-based learning practices tends to be approached as contextual or peripheral factors of sustainability education and not as foundational aspects. This discursiveness could curtail the radically transformative nature of green learning, especially in architectural studies in which place, memory and identity are part of the cognitive process of design and long-term stewardship. Introducing these threads into one another, the review helps towards a reconceptualization of green learning in spatial and cultural terms by making architectural heritage, place experience, and emotive interaction central elements of learning sustainability, and not incidental additions. This view highlights the importance of cultural sustainability as a vital conduit undergirded by place attachment and sense of belonging as contributing factors to enhancing the understanding of sustainable development in architectural and other areas of design, with particular reference to heritage-rich places where place continuity and culture cannot be decoupled by sustainable futures.

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Credit Authorship Contribution Statement

Amal Fadhil: Conceptualization, Methodology, Data collection, Formal analysis, Software, Visualization, Writing – original draft. Hoda A.S. Al-Alwan: Supervision, Methodology, Writing– review & editing, Validation.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix

Table 1: Details of the 72 peer-reviewed empirical studies

DG	Title	Year	Authors	Journal-Quartile	Country	Focus-Area	Methodology	Type-of-Study	Learning-Level	Sample Size	Main-Strategy
RQ1–Green Learning	Analysis of the Ecological Attitude and Sustainable Behavior of	2023	Yuri Lorene Hernández Fernández et al.	Q2	Colombia	Environmental sustainability and ecological behavior	Quantitative – Structural Equation Modeling (PLS-SEM)	Empirical	Higher education (undergraduate)	697 students	
	Environmental Conditions and Their Impact on Student	2025	Bustamante-Mora et al.	Q1	Peru (UNSA)	Environmental sustainability and learning performance	Systematic Mapping Review + Applied Case Study	Mixed (Quantitative + Descriptive Analysis)	Higher Education (University students)	Literature base (454 articles) + IoT classroom data	Sustainable classroom design / IoT-enabled environmental monito
	Environmental Education and Student's Perception, Behavior, and	2022	Gratiela Diana Boca , and Sinan Saraçlı	Q2	Indonesia	Environmental and social sustainability	Quantitative – Descriptive survey	Empirical	Higher Education (Undergraduate)	200 students (undergraduate)	Field and participatory environmental education activities
	Explaining the Sustainability of Universities through the Contr	2023	Yaser Mohammadi, Feyzollah Monavvarifard, Laleh Saleh, Reza Mo	Q1	Iran / Lithuania	Environmental sustainability in universities	Mixed: Systematic Review (PRISMA) + Quantitative SEM	Empirical + Review	Undergraduate / Graduate / PhD	289 students	Sustainability education, campus activities, behavioral engagem
	Exploring the Moderating Role of Environmental Education in Pro	2023	Lianfeng Ma, Pomi Shahbaz, Shamsheer ul Haq, Ismet Boz	Q1	China	Environmental sustainability & behavioral change	Quantitative – PLS-SEM	Empirical	Higher Education	2137 university students	Environmental education, sustainable consumption behavior
	Green Marketing Innovation: Opportunities from an Environmental	2022	Vanessa Prieto-Sandoval, Luz Elba Torres-Guevara, César García-	Q1	Colombia	Environmental education & sustainable behavior	Quantitative (Before–After survey)	Empirical	Higher Education	210 students	Sustainability courses; circular economy; green consumption mot
	Greening due to environmental education? Environmental knowledg	2013	Agnes Zsóka, Zsuzsanna Marjainé Szerényi, Anna Széchy, Tamás Ko	Q1	Hungary	Environmental awareness, consumption behavior	Quantitative survey + MDS + Cluster Analysis	Empirical comparative study	High School + University	3726 students (2998 university + 770 high school)	Environmental education exposure, behavioral clustering
	Impact of Integrated Sustainability Content into Undergraduate	2020	Rachel Hay, Lynne Eagle	Q1	Australia	Sustainability awareness, climate change attitudes	Quantitative (Longitudinal Survey)	Empirical (Longitudinal comparison)	Undergraduate	380 students	Curriculum integration of sustainability
	Innovation for environmental sustainability: longitudinal effec	2021	Silvia Collado, José David Moreno, José Martín-Alb	Q1	Spain	Environmental knowledge, norms, and behaviors	Quasi-experimental (Experimental vs Control + Longitudinal T0–T	Empirical	Higher Education	98 students (final)	Workshops, role-play, practical exercises, campus engagement
	Online, Experiential Sustainability Education Can Improve Stude	2024	Francesca Douglas, Kim Beasy, Kate Sollis, Emily J. Flies	Q1	Australia	Environmental attitudes, behaviours, nature connection, wellbei	Quantitative – Before/After survey	Empirical	Higher Education / Adult learners	265 paired surveys	Online experiential learning, backyard biodiversity activities
	Spanish University Students' Awareness and Perception of Sustai	2022	Miguel Leiva-Bronchi, Natalia Lajara-Camilleri, Anna Vidal-Meló	Q1	Spain	SDG awareness, sustainability literacy, sources of information	Quantitative survey	Cross-sectional empirical study	Bachelor + Master	321 students	ASK questionnaire + SDG awareness/perception survey
	Students' Attitude and Perception Towards Sustainability: The C	2022	Sharifah Nuriati Farhana Syed Azhar, Noor Adelyna Mohammed Akl	Q1	Malaysia	Sustainability attitudes & perceptions	Quantitative survey	Empirical	Undergraduate	513 students	University-wide sustainability programs; campus SDG integration
	Sustainability at universities: Students' perceptions from Gree	2018	Renata Dagilūtė, Genovaitė Liobikienė, Audrone Minelgaitė	Q1	Lithuania	Students' perceptions of sustainability in green vs non-green u	Quantitative (Survey, Regression Analysis)	Comparative empirical study	Bachelor + Master	804 students	Campus sustainability, environmental information, sustainabilit
	Sustainability education at higher education institutions: peda	2022	Yijing Wang, Malodine Sommier, Ana Vasques	Q1	Netherland s	Impact of pedagogies on sustainability competences, NEP belief,	Quantitative – Online survey, regression analysis	Empirical Study	Bachelor + Master	262 students	Pedagogical clusters (universal, social justice, environmental
	The impact of environmental education at Chinese Universities o	2024	Yibo Li, Dongli Yang, Siyuan Liu	Q1	China	Environmental attitudes & influencing factors	Quantitative (Survey, Regression)	Empirical	Undergraduate + Master + PhD	398 students	Curriculum education, subjective norms, perceived behavioral co
	The Impact of Integrating Sustainable Development Goals on Stud	2025	Wafaa Al Husban	Q1	Jordan	Impact on awareness + behavior	Quantitative – Survey; ANOVA; Regression	Case Study – University of Jordan	Undergraduate + Postgraduate	502	SDGs curriculum integration
	The Perception of Undergraduate Students From Different Educati	2024	Paul Taboada-González, Quetzalli Aguilar-Virgen	Q1	Mexico	Perception, behavior, knowledge, attitudes, institutional susta	Quantitative – Exploratory Survey	Comparative study (3 university systems)	Undergraduate (Industrial Engineering)	U1: 189, U2: 306, U3: 125	Perception–behavior–knowledge–attitude s questionnaire (55 items
	The Psychological Mechanisms of Education for Sustainable Devel	2025	Jianyang Zhang, Aochen Cao	Q1	New Zealand	ESD participation, Environmental attitudes (NEP), Environmental	Quantitative, Cross-sectional Survey + Structural Equation Mode	Empirical, mediation model testing	Undergraduate students in a mid-sized urban university	500 university students (after data cleaning)	Participation in ESD-related educational activities (lectures,
	Transforming students' green behavior through environmental edu	2025	Cai Chen, Pomi Shahbaz, Shamsheer ul Haq	Q1	China / Pakistan	Impact of HEI ecosystem + EE on students' green behavior	Quantitative – PLS-SEM	Empirical	Higher Education (HEIs)	480 students	Face-to-face cross-sectional survey
	Towards More Sustainable Higher Education Institutions: Impleme	2024	Maria E. Angelaki, Fragkiskos Bersimis, Theodoros Karvounidis,	Q1	Greece	Knowledge, perception, intention, engagement with sustainable I	Interventional Study (Pre-test / Post-test)	Descriptive statistics, Cronbach's alpha, Paired-	Undergraduate – ICT students	52 students	Embedding SDGs in ICT curriculum; 4-module sustainable IT instr
RQ2–Spatial Experience	The Effect of Students' Cognitive and Emotional Engagement on S	2023	Haider Khan, Rani Gul, Shazia Nawaz	Q3	Pakistan	Cognitive & emotional engagement strongly predict academic succ	Quantitative – Correlational Study	Cross-sectional survey	University	300 undergraduate students	Cognitive Engagement, Emotional Engagement, Productivity, Acade
	A Gamified Experiential Learning Intervention for Engaging Stud	2023	Loukia David & Nikita Weinstein	Q2	Greece	IMI – Intrinsic Motivation Inventory; Observer-rated academic w	Field Experiment (Between-Subjects Design)	Empirical – Experimental	School – English Language Learning	123 students (ages 9–16)	Autonomy, Competence, Relatedness, Engagement, Interest, Effort
	-Learning: Direct Effect of Student Learning Effectiveness and	2022	Muhammad Umar & Ilsang Ko	Q1	South Korea	Online learning effectiveness & engagement	Quantitative – Hierarchical Regression	Empirical	Undergraduate + Graduate	247 students	PBL, Team Cohesion, Flipped Learning, Engagement, Learning Effe
	Interrelationships among College Students' Perceptions of Smart	2024	Yunpeng Ma, Mingzhang Zuo, Ruiyang Gao, Yujie Yan, Heng Luo	Q2	China	Pride mediates engagement positively; anxiety mediates negative	Quantitative – Structural Equation Modeling (SEM)	Empirical (survey-based)	Undergraduate	1076 valid responses	Smart Classroom Perception (PE), Mobile Usefulness (TU), Pride,
	The Impacts of Emotional Intelligence on Students' Study Habits	2022	Javed Iqbal, Muhammad Zaheer Asghar, Muhammad Azeem Ashraf, Xie	Q2	China	EI → CE → SH (strong mediation); SA & SM directly predict study	Quantitative – Cross-sectional Survey + SEM	Empirical	Higher Education	338 health sciences students	Emotional Intelligence (SA, SM, RE, SS), Cognitive Engagement,
	Associations of Classroom Design and Classroom-Based Physical A	2021	Jani Hartikainen, Anna-Maija Poikkeus, Eero A. Haapala, Arja Sä	Q1	Finland	Sustainability Education / Place-Based Learning	Cross-sectional Study + Structural Equation Modeling	Empirical – Observational	Primary School – Grades 3 & 5	206 students	
	Measuring actual learning versus feeling of learning in respons	2019	Louis Deslauriers, Logan S. McCarty, Kelly Miller, Kristina Cal	Q1	USA	Students learn more with active learning but feel like they lea	Randomized Controlled Trial (RCT) + crossover design	Experimental – Active vs Passive Learning	Undergraduate (Introductory Physics)	149 students	Active Learning, Passive Lecture, Cognitive Effort, FOL (Feelin
	Undergraduate Students' Engagement in Project-Based Learning w	2024	Yunjeong Chang, Jasmine Choi, Mutlu Sen-Akbulut	Q1	USA / Turkey	Authentic context significantly ↑ engagement (cognitive + emoti	Sequential Explanatory Mixed-Methods (Quantitative → Qualitativ	Empirical – Treatment vs Control (Real-world vs Non-Integration Course)	Undergraduate (Technology Integration Course)	12 sections; 103 survey responses; 121 reflection	Cognitive – Emotional – Behavioral Engagement; Authentic Context
	On the Impact of Learning Cycle Teaching on Austrian High Schoo	2021	Franz Riffert, Gerda Hagenauer, Josef Krieglsteiner, Alexander St	Q1	Austria	LC improves emotional patterns, increases engagement, enhances	Quasi-experimental (Pre-Post) – Treatment vs Control	Long-term educational intervention (1–2 years)	Lower Secondary (Grades 6–8)	280 students + 7 teachers	Learning Cycle (LC); Emotions (trait & state); Self-Concept; Enj
	Correlations between modes of student cognitive engagement and	2020	Allyson Barlow & Shane Brown	Q1	USA	Physics Education / Active Learning / Cognitive Science	Quantitative – Self-report instruments + ANOVA + Partial Correl	Empirical / Correlational Study	Undergraduate STEM education	19 STEM courses; 645 students	PIPS (instructional practices), SCCEI (cognitive engagement mod
	The Community of Inquiry perspective on students' social presen	2021	Rengyue Guo, Nadira Saab, Lin Wu, Wilfried Admiraal	Q1	China & Netherland	Affectiveness + Exploration predicted artefact performance; soc	Content Analysis + Quantitative Regression	Empirical – Analysis of online discourse + performance	First-year university students	24 groups (students M age = 19)	Social Presence, Cognitive Presence, Academic Performance, Col
	Engagement of Chinese EFL Learners in Problem-Based Learning: A	2025	Qian Guo, Lillian Ismail, Halimah Jamil, Shujie Luo, Zhubin Su	Q2	China / Malaysia	PBL enhances emotional, behavioral, and cognitive engagement si	Qualitative – Classroom Observation + Field Notes + Thematic Analysis	Empirical – PBL intervention (8 weeks)	Higher Education	101 first-year undergraduate students	PBL, Cognitive Engagement, Emotional Engagement, Behavioral Eng
	How do learning technologies impact on undergraduates' emotiona	2020	Edward Venn, Jaauk Park, Line Palle Andersen, Momna Hejmadi	Q1	UK, Denmark	Community building, learning strategies, accessibility, pedagog	Integrative Review (Whittemore & Knafl framework)	Qualitative Synthesis / Literature Review	Undergraduate (Higher Education)	22 empirical studies	Emotional Engagement, Cognitive Engagement, Digital Pedagogy
	Exploring the Affordances of Place-Based Education for Advancin	2023	Felicity Hernandez Gonzalez	Q1	Australia	PBE yields holistic learning across cognitive–socio-emotional–b	Qualitative – Multiple Case Study Analysis	Secondary data (4 empirical PBE case studies)	Kindergarten – Primary – Secondary (varied)	Not numerical (based on literature cases)	Cognitive, Socio-Emotional, Behavioral learning; PBE; Sustainab
	The Bidirectional Impact of Immersive Experiential Learning on	2024	Qingchen Duan	Q2	Malaysia	Immersive experiential learning enhances emotional regulation,	Conceptual / Theoretical Analysis (Review-based)	Narrative review (theoretical synthesis)	Higher Education	— (no empirical sample)	Immersive Learning, Emotional Regulation, Intrinsic Motivation,
	Investigating Student Engagement of Online Experiential Learnin	2024	Rawan Nimri, Mona Al Hyun Yang, Elaine Chiao Ling Yang, Charles	Q1	Australia	Virtual field trips ↑ skill engagement; in-person ↑ emotional &	Mixed-method: Survey + Reflective Diaries + Assessment Marks	Experimental – Comparative (Virtual vs In-Person Field	Undergraduate (Tourism & Hotel Management)	105 students (69 virtual; 36 in-person)	Experiential Learning, Emotional Engagement, Participation, Performa
	Empirical Evidence of Factors to Improve Student Engagement fro	2024	Lara Molendijk, Ross H. Taplin, Andrew J. Brennan	Q1	Australia	Determinants of student engagement in ELAs	Mixed methods: Regression + Content Analysis	Empirical – Activity-level comparative analysis	Undergraduate (Commerce / Accounting)	34 ELAs; 557 students	Authenticity; Learning Cycle; Critical Thinking; Personally Rel
	The Role of Experiential Learning on Students' Motivation and C	2021	Yangtao Kong	Q1	China	Educational Psychology / Experiential Learning	Conceptual Analysis (Mini-review)	Theoretical Review	Higher Education	— (no empirical sample)	Experiential Learning, Motivation, Classroom Engagement, Cognit
	Teaching through Experiential Learning Cycle to Enhance Student	2020	Rohaila Yusof, Khoo Yin Yin, Norlia Mat Norwani, Zuriadah Ismai	Q3	Malaysia	Significant increase in cognitive, physical, emotional engageme	Quasi-experimental (Pre–Post)	Intervention (Kolb Experiential Learning Cycle)	Undergraduate	112 first-year accounting students	Experiential Learning Cycle, Student Engagement, Cognitive Leve

	DG	Title	Year	Authors	Journal-Quartile	Country	Focus-Area	Methodology	Type-of-Study	Learning-Level	Sample Size	Main-Strategy
40	RQ3–Heritage and Identity	Perceptions of Heritage among Students of Early Childhood and P	2021	López-Fernández, Medina, López & García-Moris	Q1	Spain	Teacher training, heritage conceptions, sustainability awarenes	Mixed Methods (Descriptive–Interpretative)	Empirical	Early Childhood Education (50) / Primary Education (99)	149 student teachers	Questionnaire (open + closed items)
41		CompARe: Design and Development of a Gamified Augmented Reality	2025	Markos Souropetsis & Eleni A. Kyza	Q1	Cyprus	Byzantine cultural heritage site – Panagia Aggeloktisti (UNESCO	Design-Based Research + Two Empirical Case Studies	Mixed (Qualitative + Quantitative)	Upper Elementary (11–12 years)	Study 1: 15 students; Study 2: 59 students	Inquiry-Based Learning + Gamified AR + Field Experience
42		Creative Experiences for Engaging Communities with Cultural Her	2022	Rodríguez Echavarría, Samaroudi, Dibble, Silverton, Dixon	Q1	United Kingdom	Urban community – Brighton & Hove (UK)	Mixed: Participatory Design + Creative Workshops + AR Developme	Urban community – Brighton & Hove (UK)	Primary to early secondary transition	Children aged 9–12 (transition stage)	Creative workshops, narrative-making, AR mapping, community eng
43		Student Concepts after a Didactic Experiment in Heritage Educat	2020	Mónica Trabajo-Rite, Jose María Cuenca-López	Q1	Spain	Cultural Heritage, Identity, Citizenship	Mixed (Pre-Post Quasi-Experimental)	Empirical Quasi-Experimental	Secondary Education (3rd year)	19 students	Field visit + Museum-school integration + Cooperative learning
44		Integrating Digital Technologies and Alternate Reality Games fo	2024	Hao-Chiang Koong Lin, Li-Wen Lu, Rueo Shan Lu	Q1	Taiwan	Cultural preservation, sustainable heritage education, immersive	Mixed Methods (Experimental + Interviews)	Empirical	Elementary School	58 students (11–12 years old)	
45		Sustainable Cultural Innovation Practice: Heritage Education in	2023	Sustainable Cultural Innovation Practice:	Q1	China / Taiwan	ICH education, cultural identity, community participation, crea	Mixed Methods (Case Study + Fieldwork + Questionnaire + SEM)	Field-based Heritage Project + Quantitative Cultural Model	University students	11 students in the field experiment + 500 survey	Field investigation, creative craft production, cultural identi
46		Research on Primary and Secondary School Intangible Cultural He	2023	Wulong Xu	-	China	Cultural Heritage Education / Sociology of Education	Mixed Methods (Surveys + Interviews + Case Studies)	Mixed (quantitative + qualitative)	Primary + Secondary students	-	Oral tradition, participatory interviews, reflective activities
47		Cultural Identity through an educational school trip: voices of	2023	Dabamona & Cater	Q3	Indonesia	Cultural identity, cultural understanding, heritage awareness	Grounded Theory – Qualitative	Qualitative – In-depth interviews + observations	Secondary education	19 indigenous Papuan secondary students	School trip + museum visit + cultural village activity
48		The Nexus between Cultural Heritage Management and the Mental H	2022	Olukemi A. Adebola	Q2	Nigeria	Nigerian urban environments	Conceptual Review + Policy Analysis		-	-	
49		The Role of Learning Resulting from Students' Experiences in Sh	2024	Silvia-Maria Chireac & Vicent García Peris	Q2	Spain	Smart Tourism – Cultural Heritage – Identity Studies	Mixed (Quantitative + Qualitative Content Analysis)	Empirical	Higher Education (Teacher Training Faculty)	129 university students	Smart tourism, cultural experience, language identity, affectiv
50		Cultural Heritage for Sustainable Education Amidst Digitalisati	2024	Orphanidou, Efthymiou & Panayiotou	Q1	Cyprus – Italy –	Cultural heritage competencies, digital skills, sustainable edu	Mixed Methods (Questionnaires + Interviews + Critical Literatur	Mixed (Exploratory)	Youth aged 14–30 (school + tertiary + dropouts)	820 questionnaire responses + 21 interviews	Hybrid learning model (Digicult) + workshops + digital heritage
51		'It's part of our community, where we live': Urban heritage and	2022	Lucy Grimshaw & Lewis Mates	Q1	UK	Post-industrial mining community – place-based heritage educati	Qualitative – Ethnography + Focus Groups + Participant Observat	Empirical	Primary school	21 children (8–10 years old)	Classroom observations, heritage walks, museum visits, focus gr
52	RQ4–Integration	AQualitative Assessment of Community Learning Initiatives f	2022	K. Peters, L. Jackson	Q1	Japan	Environmental Awareness / Behaviour Change / Community Sustaina	Qualitative (Participant Observation + Text Mining + Interviews	Empirical / Multiple Case Study	University Students + Community Members	27 participants	Community-Based Learning / ESD Practices / Public Living Room M
53		Exploring the Affordances of Place-Based Education for Adva	2023	M. Semken et al.	Q1	Australia	Cognitive-Socioemotional–Behavioral Learning in SE	Qualitative Multiple-Case Analysis	Secondary Case Study Analysis	Kindergarten to High School	84 students	PBE / Experiential Learning / Community Engagement
54		Fostering Sustainability Knowledge, Attitudes, and Behaviou	2021	Brußler & Sprenger	Q1	Germany	Sustainability Knowledge, Attitudes, Behaviours (KAB Model)	Quantitative (Pre–Post Test) + Qualitative Pedagogical Design	Empirical Intervention Study	University Students (BA + MA)	195 students	Interdisciplinary Project-Based Learning + Tutor-Supported Lear
55		Sustainability education in a botanical garden promotes env	2018	Zelenika et. al	Q1	Canada	Environmental Knowledge, Attitudes, Intentions, Willingness to	Quantitative (Pre/Post Tests + Control Group)	Experimental Field Study	Adult Learners (Employees of Organizations)	FS group = 196 GV (general visitors) = 119	Field-Based Experiential Learning + Botanical Garden Education
56		Teaching and Learning Methods for Promoting Sustainability	2022	M. Chen et al.	Q1	china _ finland	Sustainability Competences / Knowledge Levels / Teaching Method	Qualitative Content Analysis (32 empirical articles)	Systematic Literature Review	(Undergraduate Tourism	-	Collaborative–Interdisciplinary Learning / Outdoor Learning / C
57		Teaching Sustainable Development in Higher Education: Build	2016	Howlett et al.	Q1	Australia	Critical Thinking, Reflection, Interdisciplinary Learning	Qualitative Reflection + Student Feedback Analysis	Empirical Course-Based Evaluation	First-Year Undergraduate Students	100–150 students	Interdisciplinary Teaching + Critical Thinking + Reflective Pra
58		Toward behavioral learning outcomes: a case study of an exp	2025	Algurén	Q1	Sweden	Pro-Environmental Behavior + SD Key Competencies	Qualitative Summative Content Analysis	Empirical Case Study	Bachelor Students	39 students	Experiential Learning (EL) + Behavior Change Intervention
59	RQ5–Architectural Education	Architectural education 'in', 'for', and 'through' heritage	2025	T. Coles	Q2	Greece / Poland	Cultural / Environmental / Social (heritage, continuity, sustai	Theoretical + Case Study + Design Workshop (Categorical: Mixed	Theoretical + Empirical Studio Workshop	Undergraduate Architecture Students	-	Field / Campus Experience + Design Studio + Urban Analysis + Wo
60		Architectural History and Sustainable Architectural Heritage Ed	2022	T. Y. Wang, Y. Y. Lee	Q1	New Zealand	Cultural Heritage / Digital Heritage / Sustainability / Communi	Mixed: Case Study + Applied Digital Surveying + Educational Imp	Empirical (Real-life project) + Educational Case Study	Undergraduate Architecture Students (Bachelor of	-	Digital Learning / Field Visit / Project-Based Learning / HBIM
61		Combining Digital Heritage and Design Thinking: A Methodolo	2025	Ramona Quattrini – Maddalena Ferretti – Benedetta Di Leo	Q1	Italy	Cultural Heritage / Community Engagement / Digital Transformati	Mixed (Design Thinking + Field Research + Digital Surveys + Cas	Empirical + Educational Workshop + Case Study	Undergraduate / Master / International Students	-	Field Visit / Digital Learning / Co-Design / Project-Based Lear
62		Developing Methodological Framework for Addressing Sustaina	2022	Aleksandra Đorđević – Aleksandra Milovanović – Milica Milojević	Q1	Serbia + Italy +	Sustainability / Heritage / Curriculum Design	Qualitative + Analytical + Framework Development	Theoretical / Review-Based / Methodological	Higher Education (Architecture - Schools)	-	Curriculum Development / Taxonomy-Based Analysis / Learning Out
63		Embedding built heritage values in architectural design edu	2020	Nicholas Clarke – Marieke Kuipers – Sara Stroux	Q1	Netherlands (TU	Cultural Heritage / Adaptive Reuse / Education Methods	Qualitative + Didactic Experiment + Studio-Based	Empirical (Education Experiment) + Theoretical	Master-level Architecture Students	24 students	Values-Based Design / Mapping / Field Observation / Studio Work
64		Experiential learning with building craft in the architectu	2019	Johnathan Djabarouti & Christopher O'Flaherty	Q1	United Kingdom	Built Heritage / Material Understanding / Design Quality	Experimental / Quantitative + Qualitative / Pilot Study	Empirical Experiment (Hands-on Craft + Design Test)	BA + MArch Architecture Students	10 architecture students (5 per group)	Experiential Learning / Craft-Based Learning / Design Studio As
65		From Traditional to Modern: Cultural Integration and Innova	2025	Wang Yanxuan – Yuan Ruika – Nik Lukman Bin Nik Ibrahim	Q1	China / Japan /	Cultural Sustainability / Passive Design / Traditional Wisdom	Qualitative – Literature Review + Analytical Framework	Theoretical / Review-Based / Framework Proposal	Higher Education (Architecture Students)	-	Case-Based Learning / Field Studies / Studio-Based Learning
66		Harnessing Vernacular Knowledge for Contemporary Sustainabl	2024	Gazi Amir & D. M. Nuruzzaman	Q1	Italy / Spain /	Vernacular Sustainability / Knowledge Sharing / Digital Heritag	Qualitative / Analytical / Comparative / Platform Design	Theoretical + Applied Platform Development	Higher Education (Architecture Students)	-	Collaborative Digital Learning / Mapping / Case-Based Learning
67		Heritage conservation and architectural	2014	Hani Alsaif	Q3	Egypt	Heritage Conservation / Cultural Identity / Adaptive Reuse	Qualitative – Case Study + Applied Educational Model	Applied Educational Methodology + Case-Based	Senior Architecture & Interior Design Students	-	Adaptive Reuse / Documentation / Design Studio
68		Reprogramming Modernist Heritage: Enhancing Social Wellbein	2021	Latifa Al-Saffar & Ashraf Salama	Q1	Serbia	Modernist Heritage / Social Wellbeing / Value-Based Reuse	Qualitative – Design-Based Research + Programming Analysis	Theoretical + Applied Design Studio (Hybrid	Master Level Architecture Students	-	Design Studio / Value-Based Programming / Multiscale Analysis
69		Teaching about heritage and project desing in the European	2024	Juan Ignacio Prieto López & Cristóbal Crespo González	Q2	Spain + France +	European Heritage / Cultural Identity / Rehabilitation	Qualitative + Case-Based + Workshop-Based	Applied Educational Program + International Workshop	Undergraduate + Master Architecture Students	58 students+ 8 teachers	Field Visits / Collaborative Design / Workshop Learning
70		The active role of students, teachers, and stakeholders in	2021	Giada Longhi & Giulia Favaretto	Q1	Italy	Heritage Preservation / Economic Value	Problem-Based Learning (PBL) + Case Study + Project-Based	Applied Studio + Real Case Problem-Solving	Master's Degree Students	-	PBL / Field Research / GIS Analysis / Stakeholder Engagement
71		The Role of Architectural Education in Promoting Urban Heri	2019	Mona Helmy	Q3	Saudi Arabia	Urban Heritage / Cultural Identity / Sustainability	Qualitative + Case Study + Project-Based Learning	Applied Educational Experience + Studio-Based	Undergraduate Architecture Students	-	Field Visits / Design Workshops / Adaptive Reuse Projects
72		UNPACKING COMMUNITY-BASED ARCHITECTURAL PEDAGOGY: A	2025	Muhammad Nalza Mulki Iqbal & Tanzil Shafique	Q2	UK + Indonesia	Community Engagement / Sustainability / Cultural & Social Value	Systematic Review (SQLR) + Qualitative Thematic Coding	Review Study / Meta-Analysis	Not Applicable (Review includes BA + MA + PhD	95 artical	Participatory Design / Design-Build / Service Learning / Live P

التعلم الأخضر من خلال التجربة المكانية: مراجعة منهجية للوعي الثقافي بالتراث المعماري

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الخلاصة

تقدم هذه الدراسة مراجعة منهجية تستكشف إسهام التعلم الأخضر، من خلال التجربة المكانية، في تعزيز الوعي الثقافي بالتراث المعماري. على الرغم من أن التعلم الأخضر يُعرف غالبا في الأدبيات من حيث المعرفة البيئية والأداء الإيكولوجي، فإن هذه الدراسة تعيد تعريف التعلم الأخضر كاستراتيجية تعليمية شاملة تتضمن الاستدامة الثقافية، والتعلم القائم على المكان، والتعلم الوجداني في البيئة التراثية. استُخدم البحث المنهجي ضمن قواعد بيانات أكاديمية كبيرة (تغطي الفترة بين 2010 –2025) لاختيار 72 دراسة تجريبية، جرى ترميز بياناتها نوعيا باستخدام رموز موضوعية في برنامج MAXQDA 24 . استُخدم إطار الترميز الاستنتاجي على ثلاثة محاور تحليلية: توجهات التعلم الأخضر، والاستراتيجيات التربوية المكانية، ونتائج الوعي بالاستدامة فيما يتعلق بالتراث. حُددت الأنماط السائدة والفجوات المفاهيمية بين مجالات البحث باستخدام أدوات مقارنة. تُظهر النتائج وجود تباين كبير في أطر الاستدامة. تركز دراسات التعلم الأخضر على الجوانب البيئية، إلا أن البحوث القائمة على التعلم المكاني، وتعليم الهندسة المعمارية، والخلفيات التراثية، تتسم بنظرة مستقبلية أوسع، إذ تُدمج الاستدامة الثقافية والهوية والشعور بالمكان كسبل رئيسية للتوعية بالاستدامة. وعندما يكون التراث الثقافي هو الوسيلة التعليمية الأساسية، فإن أنشطة التعلم المكانية لا تُسهم فقط في الإدراك، بل تُسهم أيضا في الارتباط العاطفي والمشاركة السلوكية. وتخلص هذه المراجعة إلى أن التعلم الأخضر من خلال التجربة المكانية يُقدم إطارا تكامليا لتطوير تعلم الاستدامة متعدد الأبعاد في تعليم الهندسة المعمارية، وتوصي بضرورة دمج الاستدامة الثقافية بشكل صريح في نماذج التعلم الأخضر.

الكلمات المفتاحية: التعلم الأخضر، التجربة المكانية، الوعي الثقافي، التراث المعماري، برنامج MAXQDA