

Identifying, Validating, and Prioritizing Environmental Factors Influencing Children's Creativity: A Delphi-AHP Framework

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Detailed abstract

Introduction

Creativity is an important human capacity associated with cognitive development, adaptation, and social progress. Childhood is a formative period in which children engage with and make sense of their surroundings; therefore, environmental experiences can shape opportunities for exploration, imaginative activity, problem-solving, and interaction. The built environment may support or constrain these activities through its spatial organization, materials, sensory qualities, and flexibility. Understanding how such features relate to children's creativity is consequently relevant to the design of educational and developmental settings.

Many settings used by children are not purpose-designed for them. The source study notes that educational, recreational, and developmental activities may take place in adapted residential or commercial premises or in generic institutional buildings. Such environments can offer limited spatial variety, little contact with nature, rigid divisions, or insufficient secure open and semi-open areas. These characteristics may restrict opportunities for exploration and creative engagement. At the same time, educational and planning approaches may give less attention to spatial and sensory qualities than to formal instruction. Although prior research has discussed connections between the built environment, child development, and creativity, findings have not always been translated into a structured set of architectural criteria with empirically assessed priorities. This study addresses that practical and methodological gap through four connected objectives: identifying and synthesizing environmental factors relevant to children's creativity from documentary sources; validating the resulting indicators through expert consensus; determining relative criterion and subcriterion weights using the Analytic Hierarchy Process (AHP); and assembling an operational framework that may inform assessment and design of child-centered environments. It also examines agreement between Delphi screening and AHP priorities. The inquiry considers the physical environmental criteria and subcriteria, their mathematical weights, the extent of expert agreement on their ordering, and convergence between the two decision stages. Criteria were derived from literature on environmental design and children's developmental needs; final validation, weighting, and prioritization were undertaken by specialists in the relevant fields.

Materials and Methods

The applied, descriptive–analytical study used a sequential mixed-methods design with an exploratory phase followed by validation and prioritization. First, library and documentary sources and theoretical literature were reviewed, and their content was analyzed to identify and synthesize environmental features relevant to children’s creativity. The resulting framework comprised five main criteria: Naturalism, Stimulation, Flexibility, Calmness and Security, and Sociability and Interaction. Together, these criteria contained 15 physical and spatial subcriteria, which formed the basis of the subsequent questionnaires. The exploratory phase therefore provided both the conceptual categories and the specific indicators to be reviewed by experts, connecting the documentary synthesis with the empirical stages rather than treating the criteria as an unstructured list. The design enabled initial screening of the indicators before their relative importance was quantified.

In the second phase, the Delphi method was used to assess the proposed indicators, followed by AHP to calculate their relative weights. The target population consisted of specialists, faculty members, doctoral graduates, and doctoral candidates in architecture, urban design, and educational psychology, selected purposively from prominent Iranian academic institutions (including the Universities of Tehran, Shahid Beheshti, Iran University of Science and Technology, Art University of Tehran, Tarbiat Modares, Art University of Isfahan, Islamic Art University of Tabriz, Shahid Rajaei Teacher Training University, Ferdowsi University of Mashhad, Yazd, Shiraz, Kashan, and Gilan). Eligibility required holding or pursuing a doctorate, active academic or professional status, and a verified publication record at the intersection of environmental psychology, architecture, and children’s creativity.

Data were collected using researcher-developed, structured closed-ended questionnaires distributed across sequential rounds. In the Delphi round, an 18-item questionnaire with a 5-point Likert response scale (comprising 15 specific items for the subcriteria—three per criterion—and three items evaluating comprehensiveness, titles, and categorization) was sent electronically to 93 invited, pre-qualified experts, yielding 30 complete and valid responses. Prior to distribution, content and construct validity were verified through expert-panel review involving supervisors and specialists in child environments. Cronbach’s alpha values for the five dimensions ranged from .706 to .802 (Naturalism: .706, Stimulation: .775, Flexibility: .802, Calmness and Security: .746, Sociability and Interaction: .784), exceeding the .70 acceptability threshold. Delphi data were analyzed in SPSS using descriptive statistics, and subcriteria scoring above the theoretical midpoint were retained for the hierarchical assessment.

For the AHP stage, a pairwise-comparison questionnaire containing 25 comparisons (10 among main criteria and 15 among subcriteria) based on Saaty’s 9-point scale was administered in person and via email, yielding 23 valid and complete responses. The comparison matrices were aggregated using the geometric mean method in Microsoft Excel, and final weights were derived by normalizing the weight vectors.

Findings

The Delphi screening validated all 15 proposed subcriteria. Each had a median of at least 4, and reported agreement exceeded 80%. The ranking results showed strong expert concordance (Kendall's $W=.746$; $\chi^2=312.72$; $p<.001$). Thus, the experts' evaluations supported retaining the identified subcriteria for the prioritization stage.

AHP results based on 23 valid responses and an overall CR of .004 ranked Stimulation first among the five main criteria, with a weight of .282, followed by Naturalism, with a weight of .254. Together, these criteria accounted for 53.6% of the total weight. At the subcriterion level, the three highest global weights were assigned to mystery, adventure, and discovery under Stimulation (.150); play with natural elements and living systems under Naturalism (.134); and spatial functionality supporting social interaction and peer engagement under Sociability (.103). The five highest-ranked subcriteria collectively represented 56.7% of the total weight.

Rank-order association between Delphi screening priorities and AHP rankings was high and statistically significant: Spearman's $\rho=.832$ ($p<.001$) and Kendall's $\tau-b=.695$ ($p=.001$). Robustness analyses included 1,000 bootstrap iterations and sensitivity analysis; LOO testing found 92% invariance. These results indicate that the reported ordering was largely maintained under the specified robustness checks. The bootstrap and sensitivity procedures were included to examine the stability of the prioritization, while LOO testing assessed whether the results were invariant when individual experts were omitted. The reported percentages and coefficients describe the outcomes of these analyses; they do not imply that all criteria received equal support or that the rankings apply beyond the evaluated expert framework.

Discussion and Conclusion

The study presents a literature-informed, expert-assessed framework for organizing and prioritizing environmental factors relevant to children's creativity. The five criteria—Naturalism, Stimulation, Flexibility, Calmness and Security, and Sociability and Interaction—provide a structured way to consider different spatial and environmental aspects. Delphi results supported all 15 proposed subcriteria, while AHP supplied their relative priorities. Stimulation and Naturalism had the largest main-criterion weights and together made up just over half of the total. The leading subcriteria emphasize opportunities for discovery, engagement with natural elements and living systems, and spatial support for social interaction. These rankings reflect the judgments of the participating experts and should be interpreted as priorities within this decision framework rather than as direct measurements of children's creative outcomes.

The agreement statistics and consistency checks support the coherence of the elicited judgments: Kendall's W was .746, the AHP consistency ratio was .004, and the reported LOO invariance was 92%. The strong rank correlations also show convergence between the Delphi screening and AHP ordering. Taken together, the methods offer a transparent route from literature-derived indicators to expert-validated and weighted criteria. In practical use, the framework can help architects, urban designers, and educational planners consider exploratory spatial qualities, natural elements, adaptable arrangements, social interaction, and conditions of calmness and security when evaluating child-centered environments. It does not establish that any single feature causes creativity; its contribution is

to organize expert priorities for design and assessment. Further studies could complement expert judgments with direct observation of children's behavior and post-occupancy evaluation in varied settings, thereby testing how these prioritized features relate to use and experience across contexts. Such work would extend the present expert-based analysis by examining environments in use, while retaining the distinction between expert-assigned design priorities and observed outcomes. The framework may also serve as a basis for comparing design proposals against the same set of criteria, provided that its weights are treated as results of this study's sampled expert assessments and not as universal constants.

Declarations

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