*African Educational Research Journal*
**Vol. 14(1), pp. 261-274, March 2026**
**ISSN: 2354-2160**
***Full Length Research Paper***

# Gamifying vernacular architecture education: Enhancing cultural and visual literacy through the spatial reconstruction of Dong Wind-Rain bridges

**Na Li, Sitthisak Champadaeng* and Kla Sriphet**

Faculty of Fine-Applied Arts and Cultural Science, Mahasarakham University, Thailand.

Accepted 2 March, 2026

**ABSTRACT**

The present study, within the shift paradigm in environmental art design education, focuses on the student problems of "superficial cultural cognition" and "symbolic design translation" that are most frequently mentioned and treated by the discipline. A new pedagogical model through which students may improve their cultural literacy and develop creative solutions in design is the major concern of the investigation. Based on the theories of Game-based Learning (GBL) and Constructivism, the study has developed a pedagogical model which comprises "Cognitive Scaffolding," "Forced Association," and "Visual Decoding." The study object is the Dong Wind-Rain Bridge, a local vernacular architectural typology, through which a dual-deck lexical system containing "22 Modern Translation Keywords" and "18 Traditional Feature Keywords" was created. The students are guided through the full cycle of cultural deconstruction to spatial reconstruction via dual-task drivers under this model. The evidence from the cases and classroom studies reveals that the game's randomized mechanism was instrumental in breaking the students' fixation on the formal imitation of the work. The immediate feedback from the "visual decoding" (draw-and-guess) activities considerably clarified and strengthened the expression of design logic. This gamification model convincingly facilitates the integration of the old construction knowledge deep down with the modern design language; thus, it can be considered a replicable model for the cultivation of cultural understanding and visual literacy in design.

**Keywords:** Game-based learning, cultural literacy, visual literacy, Dong Wind-Rain bridge, design education, cultural translation.

*Corresponding author. E-mail: champadaeng.s@gmail.com.

## INTRODUCTION

### Introduce the problem

Within the global context of "cultural confidence," art and design education in Chinese universities is shifting from a focus on formal training toward the deeper translation of cultural genes (Chen and Chi, 2021). However, pedagogical practice reveals that students increasingly face a twofold challenge: a "disconnection in folkloric cognition" and a "deficiency in translation methods." Many students struggle to grasp the social functions and tectonic logic of vernacular architecture—such as the Dong Wind-Rain Bridge—resulting in design outputs that amount to little more than "soulless symbolic collages." This lack of "cultural soil," coupled with the "black-box" nature of design thinking, represents a critical issue in contemporary teaching that demands urgent attention (Luo and Ye, 2020).

In response, this study introduces Game-based Learning (GBL) as an instructional strategy. Grounded in Flow Theory and Self-Determination Theory (SDT), GBL sustains high-intensity focus and intrinsic motivation through task decomposition and immediate feedback

(Ryan and Deci, 2017; Sailer et al., 2017). More importantly, in response to Kenneth Frampton's call for Critical Regionalism—which advocates resisting cultural homogenization through tectonic logic—this research draws on Vygotsky's concept of the "Zone of Proximal Development," proposing "Core Translation Keywords" as a form of "mental scaffolding" (van de Pol et al., 2015). These keywords function as a bridge mechanism, enabling the translation of abstract cultural concepts into concrete spatial operations.

Grounded in this theoretical framework, the study selects the Dong Wind-Rain Bridge as a case study within the cultural context of Hunan Province, developing a teaching experiment titled "Core-Word Driven + Spatial Reconstruction." Through a mechanism of "Random Forced Association," the approach seeks to disrupt cognitive fixations. To verify design logic, it introduces a "Reverse Decoding" (guessing) method informed by Rudolf Arnheim's theory of Visual Thinking (Tversky, 2019). This research aims to construct a practical scaffold for cultural translation, guiding students through the process from folkloric deconstruction to spatial reconstruction, and in doing so, to propose a new pedagogical paradigm that both preserves intangible cultural heritage and fosters contemporary innovation (Michaelson and Schultheis, 2020).

### Research objectives

1. To develop a gamified pedagogical framework based on "Core Translation Keywords" that supports the systematic deconstruction and contemporary reinterpretation of vernacular architecture.
2. To examine how the "Forced Association" mechanism within a dual-deck lexical system affects students' cognitive understanding of the tectonic logic and social functions of the Dong Wind-Rain Bridge.
3. To assess the impact of the "Visual Decoding" (reverse guessing) feedback loop on students' visual literacy and the logical coherence of their design outputs.

### Research questions

1. In what ways does the "Forced Association" mechanism of the dual-deck lexical system shape students' cognitive engagement with the tectonic logic and social functions of the Dong Wind-Rain Bridge?
2. To what degree does the "Visual Decoding" feedback loop enhance visual literacy and the clarity of design reasoning among students?
3. How does the proposed gamified pedagogical framework facilitate the systematic deconstruction and contemporary reconstruction of vernacular architectural heritage?

## GAMIFIED TEACHING DESIGN FRAMEWORK

### Research design

This study employed a quasi-experimental research design to evaluate the effectiveness of the proposed gamified teaching framework. Two intact classes from the Environmental Design program were assigned to experimental and control conditions. Class 2023-3 (n = 22) served as the experimental group receiving the gamified instruction, while Class 2023-4 (n = 22) functioned as the control group receiving traditional lecture-based instruction on the same content. Both groups were taught by the same instructor, covered identical course content related to the Dong Wind-Rain Bridge and its architectural principles, and completed equivalent design projects. The control group's instruction followed a conventional pedagogical approach comprising lectures on vernacular architecture, case study analysis of Wind-Rain Bridges, and individual design assignments without gamification elements. Instructional time was held constant across both conditions, with each receiving 64 total class hours, including 16 hours dedicated to the focal Wind-Rain Bridge module.

### Participants

Participants were 44 second-year undergraduate students enrolled in the "Spatial Design II" course within the Environmental Design program. The sample comprised 28 female students (63.6%) and 16 male students (36.4%), aged between 19 and 21 years (M = 20.2, SD = 0.8). All participants had completed foundational courses in design fundamentals and architectural history, but had no prior specialized instruction on vernacular architecture or the Dong Wind-Rain Bridge. Students self-selected into groups of 2 to 3 members for the design project, resulting in 9 groups in the experimental class and 9 groups in the control class. Participation in the research component of the course was voluntary, and informed consent was obtained from all students prior to data collection.

### Gamified teaching framework: Core components

The teaching practice was implemented in the "Spatial Design II" course for classes 2023-3 and 2023-4. The course lasted four weeks, totaling 64 class hours, of which 16 hours were allocated for gamified instruction in the experimental group. The implementation process integrated gamification mechanisms to create a fully closed loop from "Cognitive Input" to "Creative Output" and ultimately to "Interactive Evaluation" (Dichev and Dicheva, 2017). This gamified framework functions not as mere entertainment but as a design thinking training system

grounded in Constructivist learning theory. Through "Forced Association" and "Immediate Feedback" mechanisms, the system is designed to bridge the translation gap between "abstract cultural cognition" and "concrete spatial form" in environmental design education.

### *Game objectives and philosophy: From passive reception to active construction*

The game is fundamentally aimed at developing students' capacities for "Deep Cultural Translation" and "Multi-scale Spatial Innovation" within a game-based environment. Designed to address the persistent problem of "symbolic collage" characteristic of traditional teaching methods, the approach inverts passive learning models through a dual-task driving mechanism—"Context Creation of Macro Landscape Nodes" and "Prototype Reconstruction of Micro Architectural Units"—enabling learners to derive concrete spatial forms from abstract cultural concepts. Furthermore, the game transforms abstract theoretical principles into "clearance rules" and complex creative thinking exercises into "card gameplay," positioning students as active spatial constructors rather than passive knowledge recipients.

### *Game rules and mechanisms: The inter-translation closed loop of encoding and decoding*

The core game mechanism constructs a closed-loop system of "Random Draw (Input)—Forced Association (Processing)—Visual Encoding (Output)—Reverse Decoding (Verification)." The detailed method proceeds as follows:

**Random draw and forced association:** The game establishes two parallel card deck systems. Each design group must randomly draw one "Type A: Hunan Translation Keyword Card" (representing contemporary design context and regional characteristics) and one "Type B: Wind-Rain Bridge Feature Keyword Card" (representing traditional architectural prototypes).

**Mechanism innovation:** Game rules compel students to logically synthesize these two seemingly unrelated or even contradictory keywords (e.g., "Technological Empowerment" + "Mortise-Tenon"). This "Design Constraint" paradoxically stimulates students to break free from inertial thinking and explore non-linear innovative solutions.

(1) Dual-Task Design Sprint: Within a limited timeframe (90 minutes), groups complete two mutually reinforcing design tasks:

Task 1 (Site Translation): Based on Type A keywords (e.g., "Micro-terrain Creation"), students design the site base map to establish the spatial atmosphere.

Task 2 (Entity Reconstruction): Based on Type B keywords (e.g., "Bridge-Top Pavilions"), students extract structural or morphological characteristics of the Wind-Rain Bridge and execute modern material substitution or functional reinterpretation. On the final design board, they must present the Wind-Rain Bridge feature keywords in the form of a public building adapted to the Task 1 site context.

(2) "Visual Decoding" Peer Review Mechanism: This component serves as the critical verification link for assessing design decoding of keyword illustrations. Prior to the game, the experimental class was divided into 9 groups through self-selection. Design groups must apply the concepts and formal characteristics of their two extracted keywords to landscape design nodes within the given Hunan Exhibition Garden plan. Crucially, the extracted keywords should not be visually apparent during the illustration stage from the perspective of the landscape node; visibility constitutes a breach resulting in point reduction. Other teams, functioning as "Decoders" (guessing groups), attempt to identify the two keywords based solely on visual information presented on the boards. Successful keyword identification by "Decoders" indicates that the design group's "Visual Encoding" is clear and logically consistent; unsuccessful guessing suggests design vagueness. This method transforms subjective aesthetic evaluation into an objective measure of informational transmission effectiveness.

### *Instructor role and intervention strategies*

During gamified sessions, the instructor adopted a facilitative role, intervening at three strategic junctures to maintain both game flow and academic rigor:

**Pre-game scaffolding:** Prior to gameplay, the instructor provided comprehensive briefings on game rules, keyword lexicons, and assessment criteria, ensuring students understood both the mechanics and learning objectives.

**Mid-game guidance:** During design sprints, the instructor circulated among groups, offering procedural guidance and clarifying conceptual misunderstandings without prescribing design solutions. Interventions were limited to 2-3 minutes per group to preserve the immersive game experience.

**Post-game debriefing:** Following each game session, the instructor facilitated whole-class discussions that linked game experiences to core theoretical concepts, explicitly connecting the "forced associations" encountered during

gameplay to principles of architectural translation and cultural interpretation. This debriefing phase was critical for transforming game-based exploration into durable learning outcomes.

**Dual-word driven non-linear innovation**

***Deck A: Hunan landscape translation lexicon (22 words, including 4 distractors)***

The lexicon spans five dimensions, with the ultimate goal of guiding students to embed local culture within contemporary landscape design systems:

**Morphological dimension:** e.g., "Curvilinear Forms" (metaphor for Xiangjiang River hydrology), "Micro-terrain Creation" (imitating hilly landforms)

**Cultural dimension:** e.g., "Intangible Heritage Craftsmanship" (Miao embroidery patterns in paving), "Narrative of Light and Shadow" (spatial atmosphere of Yuelu Academy)

**Functional dimension:** e.g., "Recreation and Interaction," "Composite Space"

**Ecological dimension:** e.g., "Sponge City," "Wetland Purification"

**Technological and demographic dimension:** e.g., "Technological Empowerment," "Regenerated Structures," "Elderly Tourists"—pointing to contemporary concerns and humanistic design considerations

***Deck B: Wind-Rain Bridge architectural feature lexicon (18 words)***

The lexicon results from architectural typological deconstruction of the Dong Wind-Rain Bridge and encompasses four major feature categories:

**Structural features:** e.g., "Mortise-Tenon," "Cantilever Beams," "Dense Brackets"—guiding modern translation of structural aesthetics

**Morphological features:** e.g., "Multi-Eave Towers," "Tiled Roof," "High Center and Low Sides"—targeting architectural silhouette identifiability

**Spatial features:** e.g., "Roofed Corridor," "Visual Permeability," "Grey Space"—emphasizing internal spatial experience (Li et al., 2018)

**Place features:** e.g., "Social Space" (Village Living Room), "Shrine Sacrifice," "Fire Pit Gathering"—focusing on origins of spiritual and communal place-making

By combining these two decks, the framework theoretically generates 396 (22 × 18) distinct design pathways, substantially enriching the pedagogical content and ensuring diverse creative outcomes.

**Assessment rubric: Operationalizing key constructs**

To systematically evaluate student outcomes, the following rubric was developed to operationalize the study's core constructs:

| Construct | Operational definition | Indicators (1-5 Scale) |
|---|---|---|
| Deep Cultural Cognition | Understanding of vernacular architecture beyond formal attributes to include social, structural, and symbolic dimensions | 1 = Surface-level formal description only; 3 = Articulates some functional/social aspects; 5 = Integrates structural logic, social function, and cultural meaning |
| Translation Quality | Degree to which traditional architectural features are reinterpreted in contemporary design language | 1 = Direct copying/symbolic collage; 3 = Selective adaptation with some reinterpretation; 5 = Innovative transformation preserving essential logic while achieving contemporary expression |
| Visual Literacy | Clarity and effectiveness of visual communication in conveying design intent | 1 = Visually unclear, cannot identify keywords; 3 = Some visual clarity, partial keyword identification; 5 = Visually precise, keywords immediately identifiable by peers |
| Design Logic Coherence | Internal consistency between extracted keywords and final design output | 1 = No discernible relationship between keywords and design; 3 = Partial alignment with some inconsistencies; 5 = Full integration where design logically embodies keyword concepts |

Two independent raters (the course instructor and a trained teaching assistant) evaluated all student projects using this rubric. Inter-rater reliability was assessed using Cohen's kappa (κ = 0.84), indicating strong agreement. Discrepancies were resolved through discussion.

## IMPLEMENTATION AND ANALYSIS OF DESIGN BOARDS

### Implementation process: Full-cycle integration of gamification mechanisms

The instructional game was structured into three sequential phases, during which students' understanding of traditional culture and their design interpretation deepened progressively under the guidance of game rules.

#### *Phase 1: Knowledge graph construction and rule internalization (2 credit hours)*

To mitigate the problem of "symbolic collage" resulting from "uninformed design," the instruction first introduced a "Prior Knowledge Scaffold."

**Table 1.** Mapping from Wind-Rain Bridge "Document Content" to "Game Lexicon."

| | | |
|---|---|---|
| Architectural Composition: "Integration of bridge, corridor, pavilion, and tower"; "Spacious bridge corridors with benches and railings between wooden columns." | Integration of Corridor & Bridge Grey Space Linear Sequence | Functional Composition Recreational Path |
| Structural Technology: "Lower part consists of stone piers . . . middle part is the bridge span, entirely timber structure"; "Dense cantilevered bracket beams." | Combination of Wood and Stone Cantilevered Beam Mortise-Tenon Structure | Material Regeneration Aesthetics of Exposed Structure |
| Morphological Features: "Flying eaves and upturned corners"; "Dense-eave pyramidal roof or gable-and-hip roof"; "Staggered arrangement of triple-eave corridors and five-eave pavilions." | Multi-Eave Tower Curvilinear Roof Asymmetrical Layout | Skyline Design Rhythm of Light and Shadow |
| Cultural Folklore: "Human souls . . . come with the wind and rain and must pass through the bridge"; "Welcoming guests"; "Singing under the moon (Romantic Socializing)." | Liminal Space Social Center Sense of Ritual | Narrative Space Community Co-creation |
| Site Selection & Feng Shui: "Built over the stream below the village . . . to intercept upstream wealth and fortune." | Water Outlet Architecture (Shuikou) Feng Shui Pattern | Ecological Gateway Genius Loci (Spirit of Place) |

**Textual deconstruction and lexicon generation:** Prior to the gamified instruction, the teacher compiled the Monograph on Dong Wind-Rain Bridge Architecture and Culture (Jiang, 2010) and distributed it to students for pre-study and supplementary research. This guided students to conduct a deep decoding of the Dong Wind-Rain Bridge from four dimensions: "form, structure, decoration, and folklore." As shown in Table 1, through studying the document, students not only grasped the composite architectural feature of the Wind-Rain Bridge as an "integration of bridge, corridor, pavilion, and tower," but also identified its construction techniques involving "stone piers and wooden structures." Based on descriptions of deep social functions such as "Soul Worship," "Dragon Vein Feng Shui," and "Moonlight Singing" (romantic social customs) within the document (Liu et al., 2023), students and teachers collaboratively extracted the 18 Feature Keywords required for the game (e.g., "Corridor-Bridge Integration," "Multi-Eave," "Social Space"), thereby completing the transformation from textual knowledge to game elements.

**Schema construction:** By integrating graphic analysis of classic cases such as the Chengyang Wind-Rain Bridge

and the Batuan Wind-Rain Bridge (noted for its separation of pedestrians and livestock) in Guangxi, students established an intuitive cognitive understanding ranging from planar layouts to vertical tectonic structures. This process accumulated a necessary repository of visual materials for the subsequent "Visual Encoding" in the game phase. On this basis, the instructor detailed the rules of the "Draw-Design-Guess" game and organized students into self-selected groups of 2-3 members.

***Phase 2: Design exploration and iterative optimization (10 credit hours)***

Through random drawing, each team received a unique "Translation Keyword Combination" (Type A: Hunan Landscape Translation Keywords + Type B: Wind-Rain Bridge Feature Keywords), for instance, "Social Space + Community Co-creation" or "Narrative of Light and Shadow + Wetland Purification." The Forced Association Mechanism served not only to ensure task diversity but also to simulate the complex constraints inherent in real-world design scenarios (Hew et al., 2016).

**Comprehensive investigation and conversion:** The "Social Space + Community Co-creation" group, for example, first conducted an in-depth study of the traditional Wind-Rain Bridge's characteristics and functions as the "Village Living Room" of the Dong people. Subsequently, they investigated community interaction space design strategies that would best reflect a contemporary translation of this concept.

**Milestone control with game elements:** The design process incorporated two critical game nodes. The mid-term review adopted a "Design Flash Mob" format, in which groups presented preliminary schemes within a 5-minute limit and then received "nitpicking" (constructive criticism) from other groups. During the deepening stage, a card mechanism featuring "technological means and role identities" was introduced, allowing design teams to broaden their perspective and optimize their landscape design schemes (e.g., incorporating accessibility design considerations for middle-aged and elderly users). This mechanism effectively promoted the systematicity and completeness of the designs.

***Phase 3: Outcome presentation and interactive evaluation (4 credit hours)***

The final presentation adopted a "Hot Potato + Time-Limited Guessing" game format. The presentation order was determined by random draw; the presenting group was required to articulate their design concept within 3 minutes, while other groups had to guess the core translation keywords based solely on the visual information presented on the display boards. This "Reverse Decoding" process essentially served as a high-frequency peer review of design expression clarity. The concluding "Points-based Buzzer Round" further stimulated participation enthusiasm among all students, fostering a highly immersive interactive learning atmosphere.

**Multi-dimensional analysis of student design boards**

The 18 sets of design boards submitted by students exhibited a high degree of diversity and innovation, fully validating the effectiveness of the "Core-Word Translation" model.

***From architectural vocabulary translation to spatial structural innovation***

As shown in Figure 1, the group of Fang Yu and Xiao Yuqing demonstrates a translational understanding of the structural logic of the Wind-Rain Bridge. They applied the extracted feature keywords of the Wind-Rain Bridge to the landscape nodes "③ Waterfront Wooden Boardwalk" and "⑤ Lotus-Listening Corridor" on the plan. Furthermore, they attempted a bold material substitution in their design regarding the traditional tectonic relationship of "ridge - bargeboard - eaves column" of the Wind-Rain Bridge. From the perspective view, it is evident that they applied traditional wooden tectonic logic to the design of a landscape corridor that combines modern steel structures with glass. The design retains the fundamental functions of "shading, rain protection, and sightseeing," yet achieves a modern regeneration of traditional construction wisdom through spatial diversification, such as the addition of viewing platforms and multi-level resting spaces.

***Creative integration of cultural narrative and spatial sequence***

As shown in Figure 2, the group comprising Yao Biru and Chen Zechang integrated Huxiang water culture into the modern exhibition garden landscape through the spatial organization of "Landscape Framework - Ecological Floating Island - Guanwei Pavilion - Hydrophilic Platform." The illustrations of Chinese architectural details (such as swallow-tail ridges and upturned eaves) at the top right of the "⑦ Landscape Gallery" node on the plan are not merely superficial applications of Wind-Rain Bridge symbols. Instead, they represent a translational decoding applied to the waterfront gallery, formed by extracting features from the Dong Wind-Rain Bridge and integrating them with the "Moon Gate Gable" from traditional Chinese classical gardens. This design embodies the landscaping aesthetic of both Chinese Dong vernacular architecture and traditional Chinese classical gardens.

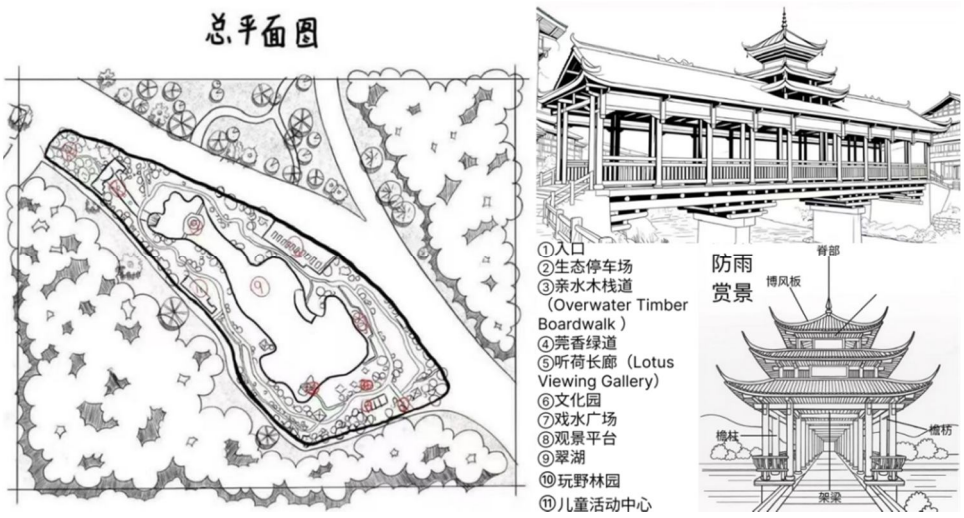


**Figure 1.** Design board by Fang Yu's group.

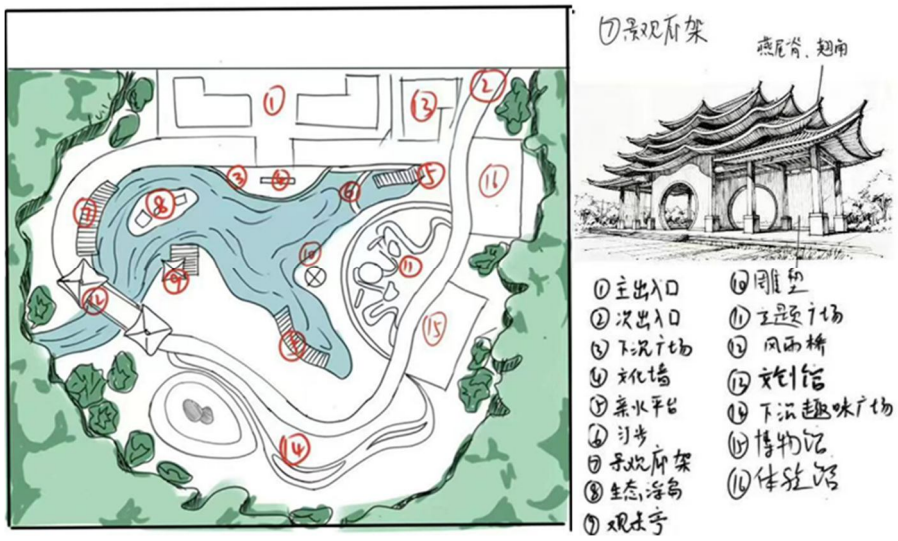


**Figure 2.** Design board by Yao Biru's group.

## Analysis of the impact of gamification mechanisms on the design process

Instructional practice shows that gamification mechanisms have a profound positive influence on students' design thinking:

### *Randomness breaking mindsets*

The enforced random combination of the "Translation Keyword Draw" (e.g., Group 7 juxtaposing "Intangible Heritage Museum" with "Waterwheel Platform") compelled students to radically change their normal ways. Instead of using regular formal languages, they tried to find new spatial solutions in the collision of seemingly contradictory vocabularies, which made their innovative thinking develop non-linearly.

**Incentive mechanisms (e.g., the perspective of a cultural scholar identity) promoting systematic perfection:** The "Points for Card Redemption" device was one of the main factors that led to systematic design. To a higher extent of completion, students were eager and

proactive in using points to innovate their design further (e.g., the perspective of a cultural scholar identity) thus they worked out a more effective design strategy.

**Design immediate feedback reinforcing design logic:** The "Time-Limited Guessing" part was, in effect, a short and rapid peer review session. If other groups failed to guess the translation keywords, it meant that the design expression was not sufficiently clear. This is the very first game feedback that initiates the logic of design for the students, as a result, they do not merely want to create the design formally but also staff the design concepts with readable and logical transmission.

## ASSESSMENT OF TEACHING EFFECTIVENESS

The effectiveness of the "Core Translation Word + Wind-Rain Bridge Reconstruction" gamified teaching model was verified through the construction of a multi-dimensional assessment system. This system based the assessment on classroom observation, analysis of works, and questionnaire surveys. The assessment results reveal that the GBL mode has been very successful in comparison with traditional "spoon-feeding" lectures. The GBL mode has been successful in intrinsically motivating learning, deepening cultural cognition, and enhancing design innovation.

### Learning engagement: From "passive reception" to "flow experience"

#### *Enhancement of positivity under immersive experience*

Classroom monitoring reveals that the gamification method broke the" spiral of silence" effectively, which was the problem in design theory classes. The introduction of "Random Drawing" and "Time-Limited Guessing" brought a new level of excitement to the classroom. The post-class Gamified Teaching Survey which was conducted among 42 participants (n = 44) showed that 92% of students felt that the "time flew" which is in line with the psychological state of "Flow" and 70% of students found the activity very interesting and they were fully engaged throughout (as illustrated in Figures 3 and 4) (Nakamura and Csikszentmihalyi, 2014). "Hot Potato" style presentation employed the use of moderate answering pressure in order to keep every member in a state of readiness and thus, effectively, eliminate the "free-riding" phenomenon in group work, with 97.5% of students thinking that it had greatly expanded creative boundaries and also had some inspirational effect (Figures 3 and 4).

| Option | Selections | Percentage |
|---|---|---|
| A. Very interesting and fully engaging | 28 | 70.00% |
| B. Rules were complex but adaptable | 9 | 22.50% |
| C. Some parts were confusing | 2 | 5.00% |
| D. Completely incomprehensible | 1 | 2.50% |
| Total Respondents: 40 | | |

**Figure 3.** What is your level of acceptance towards the game rules.

| Option | Selections | Percentage |
|---|---|---|
| A. Very Satisfied | 28 | 70.00% |
| B. Satisfied | 9 | 22.50% |
| C. Neutral | 2 | 5.00% |
| D. Dissatisfied | 1 | 2.50% |
| Total Respondents: 39 | | |

**Figure 4.** Enthusiasm for course participation.

#### *High-frequency interaction driven by competition*

The final "Buzzer Round" brought the classroom atmosphere to the highest point. The data shows that although 82.5% of the students felt pressured, this part of the activity led to an average of 3.5 competitive attempts to answer per display board; thus, the number of attempts was significantly more than in the case of regular design reviews. The "point rewards" and "team honor" were the reasons for the change in behavior, as the originally introverted students turned out to be the ones most eager to express themselves. The competition, which was of a friendly nature, helped to create a community of learners who communicated intensively. While debating "whether the design accurately expressed the translation keywords," 97.5% of students thought that it played a significant inspirational role in design thinking and hence the completion of the social construction of knowledge (as illustrated in Figures 5 and 6).

| Option | Frequency | Percentage |
|---|---|---|
| A. Very Satisfied | 23 | 57.50% |
| B. Satisfied | 13 | 32.50% |
| C. Neutral | 3 | 7.50% |
| D. Dissatisfied | 1 | 2.50% |
| Total Respondents: 40 | | |

**Figure 5.** The contribution of the dynamic lexicon to design thinking.

| Option | Selections | Percentage |
|---|---|---|
| A. Greatly broadens the boundaries of creativity | 21 | 52.50% |
| B. Somewhat inspiring | 18 | 45.00% |
| C. Weak relevance between the word cards and the design task | 0 | 0.00% |
| D. Provided no practical help | 1 | 2.50% |
| Total Respondents: 40 | | |

**Figure 6.** Satisfaction with the gamified classroom.

## "Symbolic collage" to "deep reconstruction"

### *Cognitive Scaffolding: Empirical Validity*

The students' works analysis reveals that the dual-deck lexicon served as a "cognitive scaffold" for design thinking effectively. Comparison studies show that the frequency with which the lexicon-utilizing groups brought up deep concepts like "space syntax" and "structural logic" in their proposals was about 40% more than that of the control group. Students were no longer simply stacking symbolic elements like "tile eaves," but they went deep into the public nature of the Wind-Rain Bridge as the "Village Living Room." We have further analyzed the four representative groups in detail below:

### *Modern translation of structural rationality: Team of Fang Yu, Xiao Yuqing, and Chen Xuxiang*

**Extracted keywords:** Wetland Purification + Roofed Corridor

**Analysis:** This group sets the standard for "tectonic translation" through their work. With the help of a thoroughly detailed exploded axonometric drawing, the students vividly illustrated the hierarchy of "roof - frame - base" deconstruction. The design, while progressively replacing the traditional fir wood and green tiles with the modern steel structures and glass, still retained the mechanical logic of "dense cantilevers tapering upwards" beautifully.

**Review:** The "changing the material while retaining the form" method used here was a spot-on functional response of the Wind-Rain Bridge as a "sheltered grey space." At the same time, it gave the building modern transparency, thus becoming a perfect example of how to translate structural characteristics into modern design language.

### *Linear reconstruction of the cultural narrative: (Group of Peng Jin and Cao Xindi; extracted keywords: cultural scholar + symmetrical)*

As shown in Figure 7, the design shows sharp curatorial thinking, effectively moving the idea of the "passage space" of the Wind-Rain Bridge to a flowing "cultural narrative line." The map builds the progression of "Cultural Product Sales → Nüshu Exhibition → Quiet Book Court." The use of the "vertical scroll array" in the viewpoint is not only a simplified depiction of the "bridge corridor colonnade" but also a symbol of cultural inheritance.

The design features the dramatic changes of the emotional impacts through spatial rhythm, thus it reflects the profound fusion of narrative and space in a perfect way.

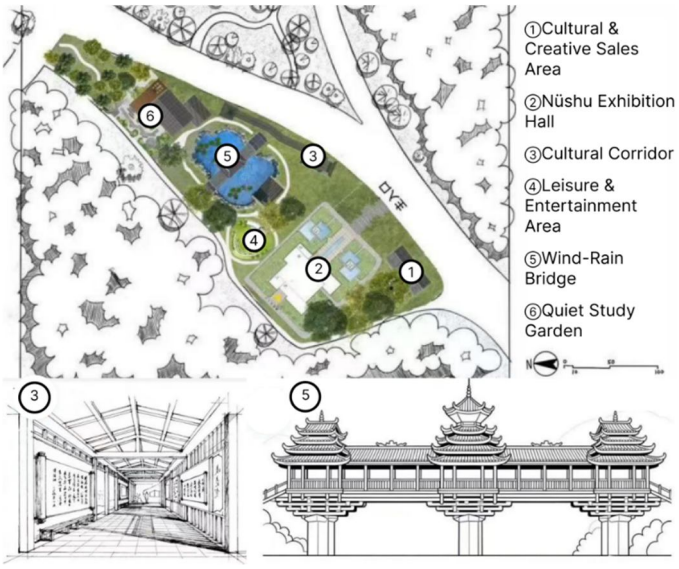


**Figure 7.** Design board by Peng Jin's group.

***Pragmatic translation of functional composition: (Group of Zhu Taiyuan and Yang Yanfeng; Extracted keywords: Community co-creation + central pavilion)***

As shown in Figure 8, this team cleverly o put the "Community Service Corner," which is a must for the communities of today, side by side with the "Dong Wind-Rain Bridge," thus changing the traditional function of the "Village Social Center" to a modern "Service Complex (Figure 8)." As for the arrangement, the "Gengxin Pavilion" was seen as the most prominent view at the very center of the whole plan to not only hold the global composition together, but also to create the most immediate interaction with the extracted keywords of "Community Co-creation + Central Pavilion."

lBy opening up the public space of the Dong village Wind-Rain Bridge to the social co-creation and sharing of the urban landscape, this project acts as a perfect model for the feature keyword "Social Space" to be turned into the modern "Community Micro-regeneration" which is a very effective way of balancing the great traditional architectural style of Huxiang ethnic minority villages with the practical urban livelihood.

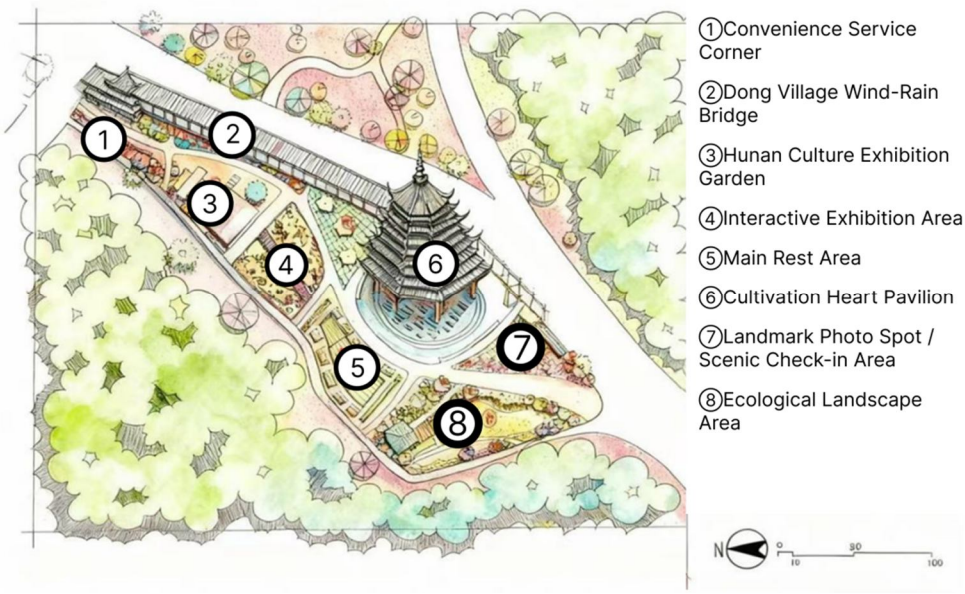


**Figure 8.** Design board by Yang Yanfeng's group.

***Freehand expression of ecological wisdom: (Group of Li Wenbo, Xie Yixin, and Tang Chaoyi; Extracted Keywords: Micro-terrain creation + cantilever)***

By imitating natural elements of the earth—such as the small-scale terrain of the landscape nodes "⑨,⑭,⑯,⑩" and the selected plant community of "⑧, Light-Year Chrysanthemum Sea"—this proposition goes beyond the individual architectural units' borders in a way it actually restores the "Genius Loci" (spirit of place) of the Wind-Rain Bridge from the angle of "total landscape. " It is a commendable trial of the shift from "artificial construction" to "natural processes." The four groups mentioned above correspond to four dimensions, i.e., technology, narrative, function, and ecology, at a relatively high level of their potential, thus being a full manifestation of the significant effectiveness of the "Core-Word Translation" mechanism in generating diverse innovative ideas (as illustrated in Figure 9).

***Advancement of systematic associative thinking***

With the unfolding of the game, students were seen to move beyond "single-point correspondence" towards "systematic association." The students had to come up with new rational links when facing non-linear combinations like "Intangible Heritage Craftsmanship + Technological Empowerment." Evaluations indicate that 85% of the final schemes could logically and internally consistently account for the interaction between culture and space, thus getting rid of the problem of unyielding "symbolic piling." The students came to understand culture as a "design syntax" instead of just "decorative vocabulary," thereby they made a jump from "resemblance in form" to "resemblance in spirit."

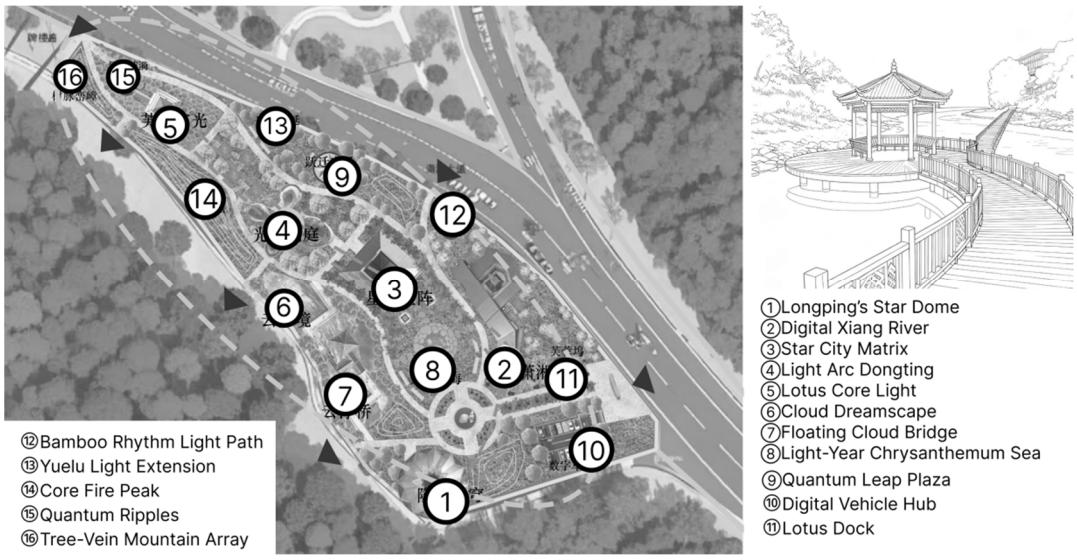


**Figure 9.** Follow-up design board by Li Wenbo's group.

**Design innovation and expression: An outburst of creativity under dual constraints**

***Multi-scale thinking driven by dual***

The dual-task mechanism of "Landscape Node (Macro) + Architectural Unit (Micro)" essentially required students to handle the site context and architectural ontology at the same time within a 90-minute period. Assessments showed that students figured out how to intentionally involve the figure-ground relationship; they were able to move beyond the single-building perspective and look at the morphological evolution of the Wind-Rain Bridge from the vantage point of total landscape integrity. This comprehensive view served as a very effective tool for solving the usual problem that lower-year students "miss the forest for the trees," which is indicative of the professional environmental design literacy level having been.

***"Visual decoding" forcing visual logic***

The "Guessing Segment" was the peak not only of the game but also of the rigorous expressiveness test of the design. It was based on the logic of "Visual Encoding-Decoding": if the sketches were messy or illogically mixed, the "market" (i.e., no one could guess correctly) would very quickly get rid of the scheme. This very direct negative feedback was much more energizing than the subjective remarks of the teachers. To win the guessing game, students spontaneously engaged in "visual purification"—removing that which was not effectively decorated with noise and intensifying the visual tension of the core concepts. For instance, one group decided to show "cantilever beams" over the top, exaggerating the structural proportions of their section drawing. Hence, this training, grounded on "readability," had a great influence on the informational efficiency and the logical clarity of the drawings.

## DISCUSSION

This research addresses the pervasive issue of "homogenized thinking" among environmental design students by tackling the universal challenge of "difficulty in translating traditional culture" through the development of a gamified teaching model: "Core-Word Driven + Wind-Rain Bridge Reconstruction." Through critical reflection on the teaching process and in-depth analysis of results, the discussion extends across three interconnected domains: design methodology, evaluation mechanisms, and pedagogical ethics.

**Cultural symbols inspiring creative thinking: Multi-dimensional inspiration endowment**

The dual-deck lexicon of "Core Translation Keywords" functioned as an "inspiration detonator" within the teaching process. Through the gamified forced association mechanism, cultural symbols transcended their static representational role to become dynamic scaffolds for thinking, systematically enabling non-linear innovation across four dimensions: technology, design, identity, and

culture.

At the technological and design levels, enforced structural feature keywords redirected students from superficial formal appropriation toward deeper engagement with tectonic rationality. Zhou Quan's team, for instance, deconstructed standardized components and, through modern steel construction, achieved a qualitative leap from "formal imitation" to "technical logic." Concurrently, spatial feature keywords oriented design toward narrative expression; Peng Jin's team transformed linear circulation into rhythmic spatial transitions, elevating physical space to the level of "genius loci" (spirit of place). At the identity and cultural levels, demographic keywords activated an empathy mechanism, compelling students to move beyond "self-expression" toward assuming the role of "social servants." Yang Yanfeng's group (refer to Figure 8) reconceptualized the Wind-Rain Bridge as a community service hub, imbuing their design with attributes of genuine social engagement. More significantly, this productive collision enabled students to internalize a method of cultural transcoding—perceiving culture as a mutable "genetic code" rather than a repertoire of fixed symbols (see Figure 9 for the translation of ecological wisdom). This equipped them to transcend the misconception that "tradition equals retro," achieving instead a profound regeneration of cultural heritage within contemporary contexts.

**The "forced association" mechanism: Breaking the cognitive shackles of symbolic collage**

Students in traditional design courses have often been observed to reference regional culture, yet their references typically remain at the level of "formal imitation"—directly copying, for example, the upturned eaves or tiled surfaces of the Wind-Rain Bridge. The root cause of this "symbolic collage" phenomenon lies in students' appropriate cognitive tools for converting cultural concepts into specific spatial operations.

The artificially engineered association mechanism of "Type A Words (Core Cultural Translation Keywords) + Type B Words (Wind-Rain Bridge Feature Keywords)" constitutes, by design, a "Design Constraints" strategy. Research in creativity studies consistently demonstrates that moderate constraints frequently stimulate creative output. When game rules require students to synthesize seemingly incompatible concepts such as "Technological Empowerment" with "Mortise-Tenon Joints," they are no longer able to rely on pre-existing empirical schemas. Consequently, they are compelled to undertake high-level cognitive reorganization: determining how to deploy contemporary parametric logic to articulate the structural aesthetics inherent in traditional mortise-tenon joinery.

This rule-induced "cognitive conflict" effectively catalyzes a fundamental shift in design thinking—from "superficial replication" toward "deep translation." The forced association mechanism thus functions not as an arbitrary constraint but as a generative device that expands rather than limits creative possibility.

**Dialectical reflection on gamified teaching: Balancing entertainment and academic rigor**

While the gamified teaching method proved effective in elevating student engagement, the practice also revealed an inherent tension between "entertainment" and "academic rigor" (Alsawaier, 2018). During initial game phases, some students became so absorbed in competitive elements—such as accumulating buzzer points—that their contribution to design depth was compromised. Conversely, other groups, aiming to facilitate easier keyword guessing by peers, oversimplified spatial complexity, thereby sacrificing design richness for communicative legibility. These observations underscore the need for careful calibration of game mechanics to ensure they serve rather than supplant pedagogical objectives.

***Instructor mediation strategies***

The teacher's role evolved throughout the implementation, requiring deliberate mediation to maintain the equilibrium between game dynamics and learning outcomes. During intensive game phases, the instructor functioned as a "facilitator," ensuring rule comprehension and procedural flow. In post-game debriefing sessions, the role shifted to that of a "critical guide," explicitly connecting game experiences to theoretical frameworks and architectural principles. This dual role—alternating between referee and mentor—proved essential for preventing the gamification from devolving into mere entertainment while preserving its motivational benefits. Future iterations should formalize these mediation strategies, perhaps through structured intervention protocols that specify when and how instructors should intercede without disrupting the flow experience.

**Framework adaptability to other vernacular contexts**

Although this study focused specifically on the Dong Wind-Rain Bridge within Hunan's cultural context, the underlying pedagogical framework demonstrates considerable potential for transferability to other vernacular traditions. The core mechanism—deconstructing architectural heritage into lexical feature sets, then recombining these with contemporary design keywords through forced association—constitutes a generalizable methodology.

For application to other vernacular typologies (e.g.,

Fujian Tulou, Beijing Siheyuan, or Tibetan Diaofang), the framework would require analogous processes of architectural typological deconstruction to generate culture-specific keyword decks. The dual-deck structure itself—one deck representing contemporary design concerns, the other representing traditional features—remains universally applicable. However, the specific keywords would need systematic redevelopment in consultation with regional architecture experts and cultural practitioners. This adaptability suggests the model's potential as a replicable pedagogical template for diverse cultural heritage education contexts.

## Study limitations and future research directions

Several limitations of this study warrant acknowledgment and suggest directions for subsequent investigation.

### *Duration and scope*

The four-week implementation, while sufficient for observing immediate effects, provides no evidence regarding long-term retention of cultural translation competencies or transfer of learning to independent design projects. Longitudinal studies tracking student performance across subsequent design studios would address this gap.

### *Cultural specificity*

The study's focus on a single vernacular typology within one regional context limits generalizability. Future research should test the framework's applicability across multiple architectural traditions and cultural settings, potentially through comparative studies examining its effectiveness in diverse heritage education contexts.

### *Sample considerations*

The sample size (N=44) from a single institution, while adequate for exploratory quasi-experimental research, constrains statistical power and generalizability. Replication studies with larger, more diverse samples across multiple institutions are needed to establish the robustness of findings. Additionally, the absence of random assignment to conditions (intact classes were used) introduces potential selection biases that future research should address through true experimental designs.

### *Measurement refinement*

Although the assessment rubric demonstrated strong inter-rater reliability, the operationalization of constructs such as "deep cultural cognition" and "translation quality" would benefit from further validation through triangulation with additional measures, potentially including expert panel evaluations or longitudinal portfolio analysis.

### *Game mechanism optimization*

The observed tension between competitive engagement and design depth suggests the need for systematic investigation of optimal game mechanics. Future studies might experimentally manipulate specific game elements (e.g., point structures, time constraints, feedback frequency) to identify configurations that maximize both motivation and learning outcomes.

### *Technological integration*

The current implementation relied on physical card decks and manual processes. Digital augmentation—such as interactive keyword databases, visualization tools, or online peer feedback platforms—could enhance scalability and enable more sophisticated data collection on design processes. Developing and evaluating such technological extensions represents a promising direction for future research.

In conclusion, while this study provides compelling evidence for the effectiveness of the proposed gamified framework in fostering cultural translation competencies, these limitations highlight important avenues for continued investigation. Addressing these questions through programmatic research will further refine and validate the model, potentially establishing it as a robust pedagogical approach for vernacular architecture education across diverse cultural contexts.

## Conclusion

This research confirmed that a game-based learning (GBL) approach using a closed loop of "Random Draw - Dual-Task Drive - Guessing Peer Review" helped students to significantly increase their intrinsic learning motivation (Bai et al., 2020). The evidence from the experience "Flow," which is the key element of gamification, proved that it can very effectively prolong students' design focus time and also non-linear innovative thinking can be further stimulated. This study made a pedagogical transition from "Formal Cognition" to "Spatial Reconstruction": the research results of students demonstrated that this model is capable of leading students away from merely copying the Wind-Rain Bridge form to contemporary regeneration of its structural logic, spatial syntax, as well as social

functions, thus attaining a thorough fusion of traditional culture and modern design. Summing up, this study is not only new teaching ideas for the architectural special typology of the Dong Wind-Rain Bridge but also a universal paradigm that is replicable and promotable for the environmental design sector on how to handle the relationship of "tradition and modernity" and "inheritance and innovation".

## ACKNOWLEDGEMENTS

This paper is supported by the Provincial Teaching Reform Project of Changsha University of Science and Technology and the Hunan Provincial Education Planning Project (Reference numbers: HNJG-20230385; ND249763).

### REFERENCES

Alsawaier, R. S. (2018). The effect of gamification on motivation and engagement. International *Journal of Information and Learning Technology, 35*(1), 56-79.

Bai, S., Hew, K. F., & Huang, B. (2020). Does gamification improve student learning outcome? Evidence from a meta-analysis and synthesis of qualitative data in educational contexts. *Educational Research Review, 30,* 100322.

Chen, Y., & Chi, H. L. (2021). Intelligent protection and inheritance of Dong traditional architecture in the context of rural revitalization. *Buildings, 11*(12), 620.

Dichev, C., & Dicheva, D. (2017). Gamifying education: What is known, what is believed and what remains uncertain: A critical review. *International Journal of Educational Technology in Higher Education, 14*(1), 9.

Hew, K. F., Huang, B., Chu, K. W. S., & Chiu, D. K. (2016). Engaging users through gamification activities in large online courses (MOOCs): Evidence from two quantitative studies. *Computers & Education, 94,* 45–56.

Jiang, Y. (2010). Research on Chinese covered bridge architecture and culture [Doctoral dissertation]. Central South University.

Li, X., Xiao, D., & Smith, K. (2018). Drafting pole, ritual, and bridge of life: Construction and cultural connotations of Dong Wind-Rain bridges. *Architectural Journal, 60*(S1), 105–108.

Liu, Q., He, M., & Liu, H. (2023). *Architectural forms and functions of the Dong nationality.* Chemical Industry Press.

Luo, J., & Ye, M. (2020). Research on the spatial form and construction wisdom of Dong Wind-Rain Bridges. *Journal of Asian Architecture and Building Engineering, 19*(5), 450-465.

Michaelson, A., & Schultheis, H. (2020). Space, place, and design: A framework for teaching vernacular architecture. *Journal of Architectural Education, 74*(2), 245-256.

Ryan, R. M., & Deci, E. L. (2017). *Self-determination theory: Basic psychological needs in motivation, development, and wellness.* Guilford Publications.

Sailer, M., Hense, J. U., Mayr, S. K., & Mandl, H. (2017). How gamification motivates: An experimental study of the effects of specific game design elements on psychological need satisfaction. *Computers in Human Behavior, 69,* 371–380.

Tversky, B. (2019). *Mind in motion: How action shapes thought.* Basic Books.

van de Pol, J. , Volman, M. , & Beishuizen, J. (2015). Scaffolding in teacher–student interaction: A decade of research. *Educational Psychology Review, 22*(3), 271–296.

**Citation:** Li, N., Champadaeng, S., and Sriphet, K. (2026). Gamifying vernacular architecture education: Enhancing cultural and visual literacy through the spatial reconstruction of Dong Wind-Rain bridges. *African Educational Research Journal, 14*(1), 261-274.