

Geometric Deconstruction and Pedagogical Adaptation of Stilt-House Architecture — Project-Based Learning Design for Junior High School "Geometry and Geometric Figures"

Canyan Wu, Nana Li, Yuanquan Tao*

School of Mathematics and Statistics, Nanning Normal University

Abstract

This paper closely follows the requirements of the Compulsory Education Mathematics Curriculum Standards, grounded in the realities of mathematics education in ethnic regions. It takes Zhuang ethnic stilt-house architecture as its research subject, systematically exploring the geometric wisdom embedded within it. Guided by project-based learning theory and adhering to principles of holistic planning, authentic contexts, and task-driven approaches, the project-based teaching design "Exploring Stilt Houses: I Am an Ethnic Architect" was developed. Through a closed-loop cycle of cultural immersion—task-driven learning—knowledge construction—exploratory practice—cultural elevation, students complete tasks such as geometric analysis reports and model construction. In junior high school mathematics, the Geometry and Geometric Shapes section serves not only as the core vehicle for cultivating students' spatial awareness, geometric intuition, and logical reasoning abilities, but also as a vital bridge connecting abstract mathematical knowledge to the real world. It holds significant importance for students' mathematical development. This approach enriches the research dimensions of ethnic mathematical culture, provides a replicable teaching paradigm, assists in overcoming the abstraction challenges in geometry instruction, and offers reference for innovative development in mathematics education within ethnic regions.

Keywords: Geometry and Figures; Junior High Mathematics; Project-Based Learning; Stilt-House Architecture; Ethnic Culture

1. Introduction

Stilted architecture stands as one of China's five most distinctive traditional residential structures, renowned for its rich geometric and graphical knowledge. The "Compulsory Education Curriculum Plan and Standards (2022 Edition)" (hereafter referred to as "Curriculum Standards") emphasizes integrating mathematical elements from China's outstanding traditional culture to enrich curriculum resources. Mathematics education in ethnic regions requires an even stronger foundation in local culture. Traditional Zhuang architecture carries profound ethnic historical significance and unique Lingnan regional cultural connotations, serving as a vivid context for mathematics education in Guangxi. The Curriculum Standards specify that project-based learning methods should be adopted in the integration and practice domain at the junior high school level. As a constructivist teaching approach, project-based learning requires creating problem-based scenarios to guide students in deep inquiry, thereby achieving deep learning. Previous teaching practices have predominantly focused on instructing and researching elements such as clothing and customs, with insufficient attention given to stilt-house architecture. This paper attempts to deconstruct its geometric essence and design a project-based teaching case suitable for the "Geometric Figures and Geometry" theme in junior high school. It aims to provide practical references for integrating ethnic culture into mathematics classroom instruction, thereby fostering students' cultural confidence and enhancing their mathematical literacy simultaneously.

2. Deconstructing the Cultural Implications and Geometric Principles of Zhuang Stilted Architecture

2.1. Historical and Cultural Value of Zhuang Stilted Architecture

The term "stilt house" originates from the phonetic translation of "house" in the ancient languages of ethnic groups in southern China. As early as the Neolithic period, stilt-house architectural sites were widely distributed across China's middle and lower Yangtze River regions, Yunnan-Guizhou Plateau, and South China. Traditional Zhuang dwellings centered on stilt-house structures, primarily featuring three-tiered wooden frameworks: upper levels for storage, middle levels for habitation, and lower levels for livestock pens. These designs offered moisture resistance and protection against wild animals, representing a quintessential residential form of the Zhuang ancestors. Stilted houses employ mortise-and-tenon joints, utilizing timber as the skeletal framework and wooden floors as the primary load-bearing structure, effectively protecting walls from damage. These structures not only contributed to the development of timber construction techniques but also exerted significant influence on anthropological and sociological research, embodying the Zhuang people's survival wisdom and cultural distinctiveness.

The geometric wisdom embedded in the structural design of Zhuang stilted houses serves as a natural vehicle for geometry education. Yang Xiaobin notes that the origin, development, and dissemination of mathematics are closely intertwined with cultural evolution in ethnic regions. Ancient Chinese geometry's origins and evolution can be glimpsed through stilted architecture in these areas. Curriculum standards emphasize that mathematics education should prioritize cultural integration, fostering an appreciation for the cultural value of mathematics to enhance mathematical literacy and comprehensive abilities. Luo Yongchao and Lü Chuanhan also note that mathematics education in ethnic regions must create contextual scenarios grounded in the cultural familiarity of local students.

2.2. Geometric Codes Embodied in Zhuang Stilt-House Architecture

The Zhuang stilted architecture represents the wisdom of integrating geometric knowledge into architectural practice. This paper systematically deconstructs the geometric principles embedded in this traditional architecture from the perspective of junior high school mathematics' "Geometric Figures and Geometry" curriculum.

2.2.1. Universal Application of Plane Geometry

Stilt-house architecture profoundly reflects the Zhuang people's masterful application of fundamental plane figure properties. The geometric logic embedded in its construction techniques aligns closely with the properties and criteria of plane figures taught in junior high mathematics.

First, rectangles are extensively employed in the building's floor plan layout—for room partitioning, door and window openings, and the cross-sections of most beams and joists. The property that all four interior angles of a rectangle are right angles provides the easiest reference for construction verification. The criterion that opposite sides are parallel and equal enables standardized material processing and efficient installation, significantly enhancing construction precision and efficiency. The craftsmen's practices align with the strategy in the People's Education Press textbook of verifying rectangles by measuring diagonals (as shown in Figure 1). The rectangular layout of stilted buildings serves as the most vivid engineering example of this knowledge.

Second, triangles are extensively used in stilted architecture, primarily at critical joints of the timber framework. Stilt-house architecture predominantly employs a post-and-lintel framework (as shown in Figure 2). Particularly at the junctions between roof trusses and beams/columns, craftsmen centered their work around the post-and-lintel components. By integrating construction techniques such as "dovetailing columns, bearing purlins on vertical posts, and connecting rafters with dovetail joints," they proactively formed stable triangular nodes. This design effectively distributes the load from the building's roof, resisting wind and rain impacts during the rainy seasons common in southern regions. The geometric principle of triangular stability is further evident in the

可以发现并证明矩形的一个判定定理：

对角线相等的平行四边形是矩形。

工人师傅在做门窗或矩形零件时，不仅要测量两组对边的长度是否分别相等，常常还要测量它们的两条对角线是否相等，以确保图形是矩形。你知道其中的道理吗？

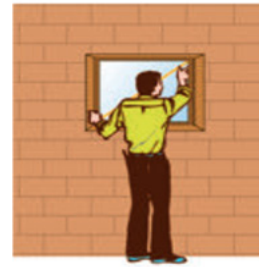


Figure 1. Application of diagonal measurement for verifying rectangles in stilt-house architecture

roof structure of pole-and-rafter buildings. As shown in Figure 3, each truss of the pitched roof is designed as a triangle, directly translating the "triangular stability" principle into the core support of the building structure—a most intuitive application of geometric knowledge.

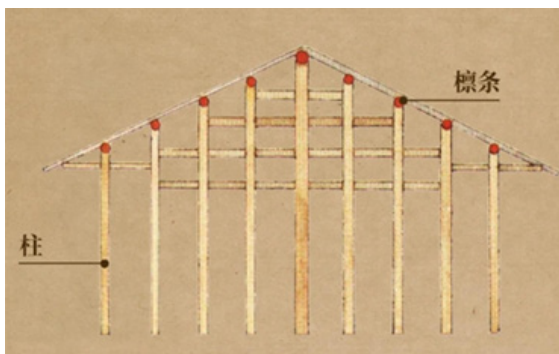


Figure 2. Post-and-Lintel Structural Framework



Figure 3. Triangular Roof Truss Structure

Stilt-house architecture also incorporates the junior high geometry concept of "constructing auxiliary lines to transform figures," a core reasoning strategy central to geometric proofs throughout junior high geometry. The rectangular frame formed by beams and columns is inherently unstable. Zhuang craftsmen address this by adding diagonal braces at the frame corners, transforming the unstable quadrilateral into one or two stable triangles. This operation is fundamentally consistent with the approach illustrated in textbooks (as shown in Figure 4). Numerous geometry problems in textbooks rely on this method of constructing triangles using auxiliary lines.

还可以发现，斜钉一根木条的四边形木架的形状不会改变。这是因为斜钉一根木条后，四边形变成两个三角形，由于三角形有稳定性，斜钉一根木条的窗框在未安装好之前也不会变形。

三角形的稳定性有广泛的应用，图 11. 1-8 表示其中一些例子。你能再举一些例子吗？



钢架桥



起重机

Figure 4. Stabilization of a Frame by Adding Diagonal Bracing

2.2.2. Intuitive Models for Solid Geometry

Teaching solid geometry often faces challenges due to a lack of visual concreteness. Middle school students struggle to connect the abstract geometric figures in textbooks with real-life contexts. Architecture, however, provides an irreplaceable physical teaching resource.

When teaching Chapter 4, "Introduction to Geometric Shapes," in the seventh-grade upper-semester textbook, the material abstracts prisms and pyramids from objects like tents, tea leaves, and pyramids. A complete stilt-house structure is itself a three-dimensional geometric treasure trove. As clearly shown in Figure 5, the lower section of the main structure—a space supported by regular columns and beams—functions as an enlarged, walk-in physical model of a right prism. The roof section, meanwhile, perfectly aligns with the definition of a triangular prism. In teaching, guiding students to observe this section allows them to vividly grasp the definition of prisms and intuitively perceive abstract properties like parallel and congruent bases, as well as lateral edges perpendicular to and of equal length to the bases. Stilt-house architecture transcends the isolated object examples found in textbooks. It functions as a systematic, composite three-dimensional geometry teaching tool. Students can not only identify simple geometric shapes described in textbooks within the physical structure but also progressively learn to decompose and understand complex composite forms encountered in daily life. This represents a crucial step in cultivating spatial visualization skills.

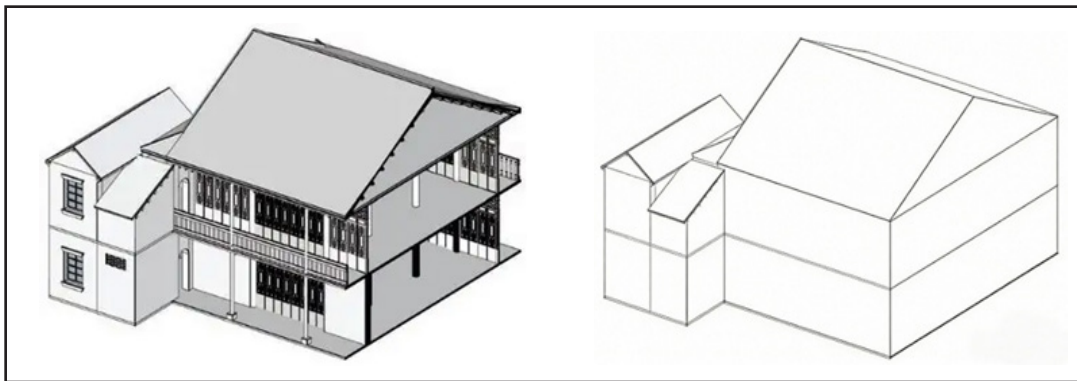


Figure 5. Stilt-House Structure as a Model of Solid Geometry

2.2.3. A Vivid Illustration of Geometric Transformations

Stilt-house architecture often embodies the mathematical beauty of symmetry, as the textbook's opening states: "Symmetry is ubiquitous—from natural landscapes to artistic creations, from buildings to..." A complete stilt-house structure typically adheres strictly to the principle of axial symmetry. Its overall outline, structural framework, and even details like pillars, doors, windows, and eaves all mirror each other symmetrically along a central axis. This makes it a complete, three-dimensional, and multi-angle observable axisymmetric figure—a vivid example of the knowledge presented in Chapter 13, "Axisymmetry," of the eighth-grade mathematics textbook. It provides students with an intuitive experience far surpassing two-dimensional diagrams for understanding the concept of "axisymmetry."

Stilt-house architecture also incorporates the geometric transformation of translation. The textbook defines translation as "moving an entire figure along a straight line to produce a new figure that is identical in shape and size to the original." In stilt houses, rows of columns, evenly spaced rafters, and repeated railing patterns can all be seen as results of translation. As shown in Figure 6, the arrangement of columns clearly demonstrates a translation transformation. Guiding students to observe and identify examples of translation in architecture is an excellent practical application of the textbook's instruction to "give examples of translation in daily life." This allows them to experience mathematics as a powerful tool for describing the laws of the world.



Figure 6. Translation in the Arrangement of Structural Columns

2.2.3. The Theoretical Basis for the Geometric Deconstruction of Zhuang Stilt-House Architecture

The Ethnomathematics research project proposed by D'Ambrosio emphasizes that, in the process of developing their own mathematical knowledge systems, different cultural groups have formed unique mathematical methods and techniques. These "ethnomathematics" are not only an important component of cultural heritage but also possess significant educational value. This theory provides academic legitimacy for extracting geometric knowledge from Zhuang stilt-house architecture—the geometric wisdom found in stilt-house architecture is not a "pre-scientific" summary of experience, but rather a concrete manifestation of the systematic mathematical thinking formed by the Zhuang people through long-term production and daily life practices, making it worthy of study and adaptation in mathematics curricula. Furthermore, Gerdes' research on traditional African architecture offers an important methodological reference in this regard. He discovered that the ornamentation and structure of buildings in the Congo, Lesotho, and other regions are not the result of random empirical accumulation, but rather the manifestation of systematic geometric thinking—the *litema* pattern, with the square as its basic unit, follows complex rules of symmetry, and architectural forms are also related to seasons, family, and rituals. Gerdes's research demonstrates that traditional architecture is the most vivid material carrier of ethnic mathematics. This paper's geometric deconstruction of Zhuang stilt-house architecture follows precisely this path, seeking to identify the "hidden geometric thinking" within it.

D'Ambrosio's theory of ethnomathematics establishes the legitimacy of mathematical exploration within ethnic cultures, while Gerdes's research on African architecture provides a methodological framework for understanding architecture as a material carrier of ethnic mathematics; together, these two approaches lay an important theoretical foundation for this study.

2.2.4. An Excellent Example of Views and Projections

Developing students' ability to observe objects from multiple perspectives is a key objective in the geometry domain. The clear structure and distinct layers of stilt-house architecture make it an ideal medium for teaching the three-view projections covered in Chapter 29, "Projections and Views," of the ninth-grade lower semester curriculum. This chapter aims to help students grasp the essence of views and apply the principles of orthographic projection to represent three-dimensional objects as two-dimensional plane figures. The construction wisdom embodied in stilt houses aligns perfectly with this concept. Zhuang craftsmen transform three-dimensional houses into two-dimensional blueprints, then fabricate components and assemble structures according to these plans—essentially employing projection thinking to achieve precise conversions between solid and flat forms. From the front view, the house appears as a regular rectangle, clearly showing the arrangement of columns, doors, and windows, depicting its height and width. From the left view, one can observe the roof's slope angle, the height of the open ground floor, and the height of the upper living space, revealing the house's depth and the

relationship between its upper and lower structures. The top view directly reveals the floor plan layout—how rooms are divided, where beams and columns are positioned, and whether there is a courtyard—displaying the predominantly rectangular plan shape. Stilted houses serve as an ideal subject for students to practice "drawing three-view diagrams based on physical objects" or "visualizing physical objects based on three-view diagrams." This process significantly trains students' spatial imagination and geometric expression skills, precisely the core competencies emphasized in the curriculum standards.

3. Project-Based Design Integrating Stilted Architecture with Geometry and Graphics

The curriculum standards explicitly state the need to "actively promote interdisciplinary integration and develop core competencies," emphasizing the cultivation of cultural confidence through real-world mathematical practice, primarily through project-based learning. Project-based learning encourages students to pose questions, conduct research, solve problems, and share outcomes within authentic or simulated real-world contexts.

3.1. Theories and Mechanisms of Project-Based Design

Project-based design in junior high school mathematics has now established a relatively mature paradigm. Liu Kun proposed a five-step process consisting of "project selection—outcome orientation—problem-driven—phased implementation—multidimensional assessment"; Wu Caixin and Luo Yongchao developed a three-in-one model comprising "decoding cultural genes—reconstructing mathematical knowledge—transforming educational practice"; The commonality among these processes lies in their use of real-world problems as drivers, practical outcomes as guides, phased implementation as safeguards, and multi-dimensional assessment as support. When implementing project-based learning in ethnic minority regions, the core lies in integrating the project's core issues with ethnic characteristics and students' ethnic living contexts, thereby conducting project-based learning within an ethnic context. Dewey believed that true learning occurs through active interaction between the learner and the environment, rather than through passive knowledge infusion. The five design principles of PBL proposed by Krajcik et al. provide a systematic framework for the implementation of project-based learning.

The "Exploring Stilt Houses: I Am an Ethnic Architect" project designed in this study is structured precisely based on these principles: using Zhuang stilt-house architecture as a real-world cultural context serves as the learning vehicle, implementing the principle of "establishing meaningful real-world contexts"; by guiding students to analyze the geometric structures within the architecture and verify the stability of triangles through inquiry activities, it embodies the principle of "conducting scientific inquiry"; group collaboration runs throughout the project, implementing the principle of "collaborating to share and refine understanding"; and through tasks such as drawing three-view diagrams and constructing architectural models, it achieves the goal of "creating a product." By using Zhuang stilt-house architecture as a vivid vehicle for geometric knowledge, this approach breaks through the abstract nature of traditional geometry instruction. It guides students to autonomously construct a system of geometric knowledge within a closed-loop process of "cultural immersion—task-driven learning—knowledge construction—inquiry-based practice—cultural elevation." Simultaneously, it integrates the survival wisdom, craftsmanship, and scientific thinking of the Zhuang people's ancestors into the entire teaching process, thereby promoting the implementation of core competencies in mathematics classrooms in ethnic minority regions.

3.2. Project-Based Teaching Case Design

This project-based learning initiative, "Exploring Stilt Houses: I Am an Ethnic Architect," follows students' systematic study of the "Shapes and Geometry" curriculum. Organized into groups of 4-5 students, they delve into the geometric mysteries of local Zhuang stilt-house architecture, achieving the goal of "learning math, applying math, and appreciating culture."

The core driving question of this project-based learning is: How can students apply their knowledge of

junior high school geometry to design and construct a stilt-house model incorporating geometric principles? Based on this core question, the teacher breaks down the project tasks into phases, as detailed below.

3.3. Teaching Practice and Effectiveness Analysis

To further validate the effectiveness of the stilt house construction project-based case study, this study randomly selected 10 participating students for interviews following the project's completion and analyzed the interview data using fuzzy set qualitative comparative analysis (fsQCA). The analysis focused on the combined

Table 1. Exploring Stilt Houses: I Am an Ethnic Architect Teaching Case Design

Phase	Core Question	Task Breakdown	Assessment Method	Design Intent
Phase One: Cultural Immersion	Why did stilted architecture become the Zhuang people's ingenious solution for adapting to the Lingnan environment?	In-Class: Screen a documentary on stilted architecture, focusing on its post-and-lintel framework, mortise-and-tenon craftsmanship, three-tier functional layout, and the wisdom behind these designs.	Primarily formative assessment: Observe students' ability to identify architectural functions and structural features in class.	Guided by the principle of authentic contexts, this approach uses students' local culture as a starting point to spark learning interest and cultural identity, providing a meaningful context for geometric knowledge.
	Which parts of this traditional architecture remind you of geometric shapes you've learned?	Outside Class: Groups interview elders, research materials, or conduct field visits to collect photos of local stilted structures and attempt to sketch their general outlines.		
Phase Two: Knowledge Construction	Why are triangles extensively used in the roofs and joints of stilted buildings? What would happen if they were replaced with quadrilaterals?	Analyze architectural drawings to identify applications of rectangles and discuss their significance for construction verification and material standardization. Focus on post-and-lintel framework diagrams to locate triangular structures, experimentally validate their stability, and compare with quadrilateral designs.	Conduct an expressive evaluation: 1. Evaluate the triangular stability experiment report. 2. Geometric identification diagrams: Label geometric shapes and transformations in architecture; 3. Three-view sketches: Assess basic accuracy of projection relationships.	Through holistic planning principles, systematically map knowledge points under geometric themes—properties, determinations, transformations, views—to architectural structures, breaking knowledge fragmentation and building comprehensive understanding.
	How can we describe the elevation and plan layout of stilted buildings using mathematical language?	Observe the building's overall form and details to identify axial symmetry and translation phenomena, then describe them using mathematical language.		
	How can a three-dimensional stilt house be accurately represented using a set of two-dimensional figures?	Abstract the lower structure as a rectangular prism and the roof as a combination of pyramids and triangular prisms to establish a three-dimensional model. Learn three-view drawing by practicing sketches of front, side, and top views from different architectural perspectives.		

Phase Three: Inquiry and Practice	Apply acquired geometric knowledge to collaboratively design and construct a physical model showcasing stilt house characteristics and structural stability, accompanied by complete drawings.	Design the "Ethnic Architect" project: Discuss in groups to determine model scale, materials, core geometric features, etc. Develop a model design proposal including design sketches, division of labor plans, and material lists.	Evaluate the model design proposal and architectural model based on design feasibility, integration of geometric elements, structural stability, and representation of geometric features.	Task-Driven Principle: Centered on the complex, open-ended core task of designing and constructing a model, this approach transforms abstract knowledge into a concrete, actionable, and collaborative project with a clear outcome-oriented focus.
		Based on the plan, use tools to draw three-view construction drawings according to specifications. Hands-on construction of the architectural model ensures structural stability and accurate representation of design intent.		
Phase Four: Presentation and Cultural Elevation	How do our works embody the fusion of geometric knowledge and ethnic wisdom?	Host a stilt-house geometry art exhibition showcasing models, drawings, and reports. Each group presents their work, highlights design features, and answers questions from peers and teachers.	Conduct a comprehensive evaluation integrating self-assessment, peer review, and instructor feedback to form a holistic, objective assessment of project-based learning.	This closes the loop of cultural immersion and elevation, transforming learning outcomes into public knowledge through exhibitions and defenses, achieving the ultimate goal of mutual benefit in knowledge acquisition and cultural preservation.
	What thinking and spirit beyond mathematics can we learn from stilt-house architecture?	Implement a comprehensive evaluation combining student self-assessment, peer group evaluation, and teacher assessment. Teachers summarize and organize the geometric knowledge thread and cultural heritage thread, deepening understanding of wisdom in adapting to nature and cultural confidence.		

influence of three antecedent conditions—cultural context integration, project task engagement, and group collaboration support—on the outcome variable, “understanding of geometric concepts.”

The analysis of necessary conditions revealed that the consistency coefficient for cultural context immersion was 0.875, approaching the empirical standard of strong necessity (0.9); its coverage coefficient was also 0.875, indicating that this condition strongly explains cases of high understanding levels. It can thus be concluded that high cultural contextual immersion is a quasi-necessary condition for students to achieve deep geometric understanding; that is, without sufficient identification with and engagement in the cultural context of stilted architecture, students find it difficult to deeply internalize and transfer geometric concepts. Furthermore, the consistency of sufficiency for cultural context immersion is 0.744, indicating that it possesses independent predictive power regarding the level of understanding. This finding confirms, from a constructual perspective, the irreplaceable nature of the cultural context within the combination of conditions; even when task engagement or collaboration levels are similar, differences in the degree of cultural immersion will still influence learning outcomes.

Overall, the fsQCA analysis results indicate that cultural factors are a key determinant of learning outcomes.

This empirical finding aligns closely with the theoretical premise of this study: the ethnic cultural context embodied by Zhuang stilt-house architecture is not merely a decorative element in instructional design, but a critical variable that triggers deep cognitive processing and lowers the threshold for learning abstract geometry. These findings also provide empirical support from classroom teaching practice for D'Ambrosio's assertion that "ethnic mathematics holds educational value" and Gerdes' argument that "traditional architecture serves as the most vivid material carrier of ethnic mathematics."

3.4. Teaching Reflection and Summary

This project-based learning scenario was authentic and effective. Using the familiar Zhuang stilt-house architecture as an investigative vehicle, it transformed abstract geometric concepts into tangible, actionable tasks. This approach significantly reduced the difficulty of learning geometry for students in ethnic regions, helping them grasp that mathematics originates from and applies to real life. It strengthened their identification with and pride in local culture, achieving a win-win outcome for knowledge acquisition and cultural preservation.

Furthermore, this project-based learning approach is highly practical. The materials used for experimental inquiry and model construction are common and readily available. The difficulty level for students to engage in group collaboration is relatively low, making it suitable for implementation in schools within Zhuang ethnic regions. It imposes minimal demands on both schools and teachers. This highly feasible project-based learning approach facilitates the organic integration of geometric knowledge, ethnic culture, and scientific spirit, subtly fostering interdisciplinary education. It not only effectively achieves curriculum standards but also strengthens students' cultural confidence and patriotic sentiments, contributing to their holistic development. However, this project-based learning requires a longer implementation period, with model construction demanding significant time and certain prerequisites from students, such as in-depth research on stilt-house architecture or field observations.

In summary, this project-based learning approach provides a replicable model for integrating ethnic mathematical culture into junior high school geometry instruction. It helps ethnic regions overcome the challenges of abstract geometry teaching and cultural disconnect, thereby advancing innovative development in mathematics education within these areas.

4. Conclusion and Outlook

This study centers on the Zhuang ethnic group's stilt-house architecture as a living cultural heritage, aligning with curriculum standards to construct a "cultural immersion—task-driven—Knowledge Construction—Inquiry Practice—Cultural Sublimation" pathway. It systematically explores the geometric knowledge embedded within the architecture and designs teaching cases for junior high school mathematics geometry themes in ethnic regions based on project-based learning theory. This achieves the effective transformation of ethnic cultural resources into mathematics curriculum resources, offering new perspectives and feasible solutions for the research and teaching practice of ethnic mathematical culture.

Theoretically, this study deepens the research dimensions and analytical framework of ethnic mathematical culture. Through meticulous deconstruction, it clarifies the concrete manifestations of Zhuang stilt-house architecture across four major geometric domains: plane figures, solid geometry, geometric transformations, and view projections. This deconstruction not only confirms the pervasive presence of mathematical knowledge in ethnic production and daily life but also reveals the abstract geometric principles and structured thinking embedded in traditional Zhuang architecture. It addresses the limitations of previous ethnic mathematical culture research, which often focused on superficial elements like clothing and games, providing a systematic analytical approach for extracting mathematical elements from material cultural heritage.

The designed teaching case, "Exploring Stilt Houses: I Am an Ethnic Architect," centers on the core driving question: "Design and construct a stilt house model embodying ethnic wisdom using geometric knowledge." It breaks down complex projects into manageable steps, ultimately yielding diverse outcomes such as geometric analysis reports and simplified architectural models. This case effectively transforms abstract geometric concepts into tangible, actionable activities for exploration. Furthermore, in terms of applied value, this study provides a replicable paradigm for developing mathematics curriculum resources and supporting teaching practices in ethnic regions.

In summary, integrating Zhuang ethnic stilt-house architecture into junior high mathematics geometry instruction represents a valuable endeavor that harmonizes mathematical logic, ethnic cultural logic, and student learning logic. Practically, it offers a viable pathway for ethnic regions to overcome geometry teaching challenges and achieve core competency goals. This approach holds positive significance for advancing cultural integration and innovative development in mathematics education while preserving China's outstanding traditional culture.

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Author Biographies

1. Canyan Wu, Master's candidate, School of Mathematics and Statistics, Nanning Normal University. Research

focuses on secondary mathematics classroom teaching and ethnic mathematical culture.

2. Nana Li, Master's degree, School of Mathematics and Statistics, Nanning Normal University. Research concentrates on secondary mathematics classroom teaching with extensive teaching experience.

3. Yuanquan Tao, Master's degree, School of Teacher Education, Nanning Normal University. Associate Professor specializing in secondary mathematics instructional design and mathematics classroom teaching.

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