From Concept to Practice: The Effectiveness and Study of Problem-Based Learning (PBL) in Higher Education Design Courses

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***Abstract*—Over the years, Hakka culture in Taiwan has evolved into a globally recognized cultural phenomenon, with Taiwan at its core—thanks to active government promotion and collaboration with local communities. However, due to the geographic concentration of Hakka populations in both northern and southern Taiwan, variations in floral symbols and their associated meanings have emerged, sometimes leading to confusion in cultural identity. This study adopts the Problem-Based Learning (PBL) model within a design curriculum, enabling students to apply ethnographic research methods to investigate the floral culture of the Liudui Hakka communities in southern Taiwan. Students also utilize the KJ method to clarify design problems and synthesize cultural insights into practical solutions. In addition, the course incorporates semiotic analysis to interpret the aesthetic and symbolic layers of the Hakka flower (*Magnolia coco*) through three dimensions: External Beauty, Behavioral Beauty, and Inner Beauty. These insights are then translated into product design elements. Based on statistical analysis of course outcomes, the study finds that the PBL-driven process effectively enhances students' abilities to collect and interpret cultural knowledge, develop design strategies through creative thinking, and ultimately produce a wooden cutting board that reflects the cultural symbolism of the Liudui Hakka flower.**

***Keywords*—higher education, Problem-Based Learning (PBL), design courses, Liudui Hakka, Hakka Flower (*Magnolia coco*), wooden cutting boards, cultural and creative product design**

I. Introduction

The Hakka population in Taiwan is primarily concentrated in the northern and southern regions. Due to differences in time and geographical location, cultural developments in these two areas differ, especially in the use of symbolic meanings and cultural representations. In the southern Liudui region, floral designs featuring the Hakka Flower (*Magnolia coco*) are deeply embedded with unique local characteristics and cultural heritage. However, how to transform these cultural elements into modern design products presents a challenge for contemporary designers. This study explores the application of PBL in integrating Hakka floral designs into innovative product development. As Hakka culture plays a significant role in contemporary society, the increasing demand for cultural heritage preservation and innovative design raises the crucial question of how to combine cultural elements with market demands in design education. Through PBL, along with ethnography and semiotics, this study conducts an in-depth analysis of the Hakka Flower in the Liudui region and develops design products that meet contemporary needs.

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II. Literature Review

The Hakka magnolia, a traditional flower with profound symbolic meaning in Hakka culture, serves as a vital cultural emblem. By delving into the study of the Hakka magnolia, we can not only understand its practical uses and symbolic connotations in daily life but also explore its significant role within Hakka culture. This study will examine how the flower reflects Hakka values, traditional customs, and social identity. Additionally, we will investigate the application of Project-Based Learning (PBL) in the field of education, its impact on students' learning outcomes and autonomy, as well as its implementation across different disciplines, evaluating its value and advantages in modern education.

A. Hakka Magnolia and Its Cultural Implications

Hakka floral traditions carry both aesthetic and cultural significance. In southern Taiwan's Liudui region, the magnolia flower (*Magnolia coco*) reflects the ecological and cultural values of the Hakka people. While scholars have analyzed its symbolic meaning through semiotics, modern design must reinterpret such traditions thoughtfully. The saying "Tung Blossoms in the North, Magnolia in the South" highlights the regional symbolism of flowers in Hakka culture. Unlike the well-known tung blossom, the magnolia is lesser known but equally meaningful. Its nocturnal blooming parallels the hardworking lives of Hakka women, who labored under the sun and returned home at night. Thus, the magnolia serves as a metaphor for their resilience, modesty, and enduring spirit [1].

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B. Problem-Based Learning (PBL) Model

Problem-Based Learning (PBL) is a student-centered learning approach that emphasizes acquiring knowledge and skills through the process of solving real-world problems [2]. This study adopts the PBL model by introducing concrete design challenges, such as the application of Hakka Nyctanthes flower motifs, to guide students in developing design solutions. The course follows an 18-week instructional plan using innovative teaching methods and the PBL approach. Through this course, students gain an understanding of the current state and development of the Hakka cultural and creative industry. They engage in field research to collect cultural resources, analyze the market for existing Hakka products, and derive design inspiration from everyday life. This process ultimately leads to the development of Hakka cultural and creative products and the formulation of product design strategies. The teaching plan is divided into four stages and methods:

(1) Introduction to the Hakka Cultural and Creative Industry – This stage helps students understand the current industry landscape and trends.
(2) Hakka Cultural Industry and Market Analysis – Students learn to collect literature and develop the ability to define product positioning.
(3) Investigation and Utilization of Hakka Cultural Industry Resources – Students conduct field research, analyze, and integrate cultural resources.
(4) Design and Development of Hakka Cultural and Creative Products – Students develop problem-solving skills through the process of ideation and product development.

Integrating Cultural Identity and Design Education through PBL This study is situated at the intersection of cultural preservation and innovative design education. It explores the integration of Hakka cultural symbols, specifically the magnolia flower, into a Project-Based Learning (PBL) framework to cultivate students' design thinking, cultural awareness, and creative competencies.

This study contributes to the academic discourse on PBL by demonstrating how ethnographic cultural research can be meaningfully incorporated into design education, thus fostering both creative innovation and cultural continuity. It offers a model for using PBL not merely as a teaching strategy, but as a framework for cultural storytelling and identity-based product design, enriching both the field of design pedagogy and the sustainable development of local cultural industries.

III. Materials and Methods

This chapter aims to explore the research methods and design process adopted in this study. Through the application of ethnography and the KJ method, semiotic analysis of the Hakka yeh-hop flower, and the design development process, the study delves into an in-depth analysis and interpretation of the research theme.

A. The Hakka Flower and Semiotics

This study explores the semiotic interpretation of the Hakka flower motif within the framework of cultural and creative product design. The theoretical foundation integrates insights from multiple semiotic traditions to form a cohesive interpretative model. Drawing from Charles Peirce's (1839–1914) triadic model—sign, interpretant, and object—this study categorizes signs into icons, indexes, and symbols. Peirce's pragmatic approach underlines the relationship between form and meaning through usage and context. Complementing this, Ferdinand de Saussure's (1857–1913), structuralist perspective introduces the dichotomy of signifier and signified, analyzed along paradigmatic and syntagmatic axes to elucidate the internal structure of signs. Charles Morris (1901–1979) extends this understanding through his three dimensions—syntax, semantics, and pragmatics—clarifying the interplay between literal and implied meanings. Roland Barthes' (1915–1980) layered model, emphasizing denotation, connotation, and myth, enriches the interpretive depth, while Umberto Eco's (1932–2016) semiotic regulation and sign production frameworks reveal the dynamic processes by which signs generate cultural meaning. In addition, Hoshino Katsumi (born 1940) contextualizes signs within the realm of commodity value, framing them as mediators of both practical utility and symbolic expression in product design [3–5]. Synthesizing these approaches, this study proposes a tripartite aesthetic framework—external aesthetics, behavioral aesthetics, and intrinsic aesthetics—to guide the design of culturally embedded yet market-responsive products [6]. By aligning semiotic interpretation with cultural identity and consumer perception, the research aims to bridge theoretical semiotics and practical design, offering a foundation for developing unique and meaningful cultural and creative products.

(1) External Aesthetics: This layer draws on Saussure's and Roland Barthes' theories of "signifier/signified" and "denotation/connotation". According to Saussure, the signifier refers to the physical form—such as the shape, color, and texture of a flower—while the signified pertains to the underlying meanings, such as "elegance", "purity", or "feminine softness". Barthes further distinguishes between denotation, the literal meaning, and connotation, the cultural or symbolic implication, asserting that the surface features of a designed object carry traditional cultural meanings. In product design, this conceptual layer translates into a visual language of form—for instance, employing streamlined edges to suggest the outline of petals, or using warm wood grains to echo the natural texture of flowers.
(2) Behavioral Aesthetics: This layer is informed by Peirce's "triadic model of signs" and Morris's concept of the "pragmatic dimension" of semiotics. Peirce categorizes signs into icons, indexes, and symbols. The nocturnal blooming behavior of the Hakka Flower serves as an indexical sign, pointing to feminine qualities such as modesty and restraint. According to Morris, the pragmatic layer emphasizes the interaction between users and signs—an essential shift toward a design-oriented

perspective. In this context, the cultural behavior symbolized by the Hakka Flower—women working by day and returning home at night—is transformed into usage scenarios and interactive logic. This study translates the metaphor of "daily toil and nightly return" into a cutting board design that allows for "hanging storage, nighttime drying, and double-sided use", thereby reflecting the flower's metaphorical rhythm of "blooming at night and closing by day", and imbuing the product with a culturally resonant tempo of "daytime use, nighttime stillness".

(3) Intrinsic Aesthetics: This layer is rooted in Barthes's concept of myth and Eco's theory of semiotic production. In Barthes's terms, "myth" refers to a system of symbols constructed through socio-historical processes. The Hakka Flower is not merely a natural plant but has become a symbolic "myth" representing the resilience and loyalty of Hakka women. Eco emphasizes the normativity of semiotic production in design—how signs are reproduced and embedded within a social context. This deepest layer, referred to as "Intrinsic Aesthetics", conveys core cultural values, positioning the product not merely as a utilitarian object, but as a medium for expressing historical narratives and cultural beliefs. The design language incorporates storytelling, packaging text, or brand visual elements to highlight the "spirit of the Hakka Flower" as the central brand ethos.

The aforementioned theories provide a framework for understanding different levels and functions of semiotics within this study.

B. Ethnography and the KJ Method

This study adopts an ethnographic approach through in-depth interviews and field research to understand the cultural background of the Hakka yeh-hop flower in the Liudui region of southern Taiwan. To further refine design problems, the KJ method was utilized to classify and organize data, thereby identifying key aspects of the design process. The study applies the KJ method and semiotics. First, the research team employed the KJ method, developed by Japanese anthropologist Kawakita Jiro [7], as an effective tool for problem-solving in creative design [8–12]. The KJ method consists of four primary steps:

(1) Data Collection: Keywords related to Hakka floral culture were gathered, each represented on individual cards. Examples include: a. Northern tung tree vs. southern yeh-hop flower. b. Magnolia family. c. Grows at an altitude of 600–900 meters. d. Blooms at night. e. Represents the perseverance of Hakka women. f. Symbolizes Hakka women working from dawn till dusk, conveying their dedication to family.

(2) Categorization and Grouping: Cards with similar content were grouped and assigned descriptive labels. For instance: a. The keywords "Magnolia family", "Grows at an altitude of 600–900 meters", and "Blooms at night" were grouped under "Botanical Characteristics". b. The keywords "Represents the perseverance of Hakka women" and "Symbolizes Hakka women working from dawn till dusk" were grouped under "Symbolic Meaning".

(3) Visual Representation: The categorized cards were arranged on a large poster, and lines were drawn to indicate relationships between different categories.

(4) Narration and Elaboration: The insights gained from the KJ method were transformed into narratives, articles, or oral presentations for further interpretation and communication (Figs. 1 and 2).

C. Design Development and Process

Under the Problem-Based Learning (PBL) approach, students worked in groups to explore cultural elements of the yeh-hop flower through design thinking methodologies. By utilizing materials and techniques, they developed wooden cutting boards inspired by the Hakka Flower (*Magnolia coco*) [13, 14]. The design process consisted of four phases:

(1) Formulation of Design Guidelines: Determining the design attributes, including shape, material, color, and texture, to establish the criteria for cultural and creative product design.

(2) Concept Development: Creating initial "Idea Sketches", selecting one preliminary sketch, and generating three-view drawings (front, top, side, and perspective views).

(3) Prototyping and Evaluation: Producing scale models to verify proportions and conducting feasibility studies, considering ergonomics, physics, and mechanical properties.

(4) Final Product Development: Producing detailed 3D renderings at a 1:1 scale and executing the final manufacturing process, including material preparation, cutting, planing, dimensioning, sanding, rounding edges, surface protection, and final inspection (Figs. 3–6).

Fig. 1. The process of data collection using the KJ method.

Fig. 2. The process of classification and grouping using the KJ method.

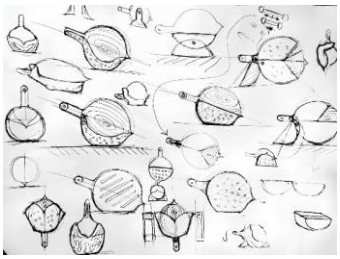

Fig. 3. Sketch of wooden cutting board and drying rack.

Fig. 4. 3D model of wooden cutting board.

Fig. 5. Wooden cutting board drying rack.

Fig. 6. Finished Hakka *Magnolia coco* wooden cutting board.

IV. Result and Discussion

This study evaluates the effectiveness of the PBL (Problem-Based Learning) model in the curriculum by surveying 57 graduate students from the Institute of Hakka Cultural Industry and the Institute of Wood Science and Design at National Pingtung University of Science and Technology. It explores the improvement of students' learning performance and creativity. The discussion is divided into three sections: statistical analysis, result discussion, and the learning outcomes and challenges.

A. Research Results and Analysis

The results indicate that under the PBL model, students were able to effectively integrate Hakka culture with design innovation, particularly in the design of the Hakka Flower (*Magnolia coco*) wood cutting boards from the Southern Liudui region, showing a deep understanding and creative expression. The students, through Hakka culture, semiotics, the KJ method, and practical design development, successfully transformed the cultural elements of Yihehua into marketable products (Figs. 7 and 8). The survey period was from February 2021 to January 2024. A total of 57 graduate students from the Hakka Cultural Industry Research Institute and the Department of Wood Science and Design at National Pingtung University of Science and Technology participated in this course. The course is an elective, and the subjects included in the course are Cultural and Creative Product Design and Marketing, Hakka Product Development and Management, and Design and Creative Topics. The participants included both full-time graduate students and working professional students (such as those in the cultural and creative industries, chefs, designers, and civil servants) (1 = Strongly Disagree, 5 = Strongly Agree).

Fig. 7. Hakka-Element wooden cutting board.

Fig. 8. Student cutting board creations.

B. PBL Problem-Based Learning

The questionnaire covered four parts: learning content and skills, participation level (teamwork), task accomplishment, and summary. The detailed results are shown in Table I. The overall average score was 4.56 out of 5, indicating a highly positive student attitude toward the PBL model in the course. "Critical thinking improvement" (4.87), "Effective use of diverse information for problem-solving" (4.83), and "Enhancing self-learning skills" (4.76) received near-perfect scores, demonstrating PBL's effectiveness in fostering critical thinking and practical academic skills. However, "Knowledge integration" scored lower (3.93), suggesting students needed clearer guidance in linking new and prior knowledge. In teamwork, the highest score was "Enhancing teamwork and communication skills" (4.83), though "Learning different expression techniques" (3.71) was the lowest, indicating challenges in adapting to diverse perspectives. In task completion, "Enhancing problem-solving ability" (4.86) and "Managing work progress" (4.61) were high-scoring, showing PBL helped students complete design projects effectively. However, "Actively participating in team tasks" (4.14) was slightly

lower, implying that some students struggled with autonomy.

TABLE I. AVERAGE SCORES FOR QUESTIONNAIRE ITEMS

Section	Type	Item	Average Score
Learning Content and Skills	1	Understanding the PBL concept and course design	4.63
	2	Enhancing understanding and knowledge acquisition through PBL	4.78
	3	Linking new knowledge with prior learning through PBL	3.93
	4	PBL increases learning motivation during problem-solving	4.77
	5	Effectively using diverse information for problem-solving	4.83
	6	Improving theoretical and practical integration ability	4.21
	7	Enhancing self-learning skills	4.76
	8	Increasing critical thinking ability	4.87
	9	Improving problem-examining techniques	4.42
	10	Teacher guidance in problem-solving methods	4.67
Participation (Teamwork)	11	Understanding the importance of teamwork in organization training	4.78
	12	Coordinating and collaborating in team discussions	4.25
	13	Enhancing teamwork and communication skills	4.83
	14	Sharing and discussing collected data	3.92
	15	Learning different expression techniques through group discussions	3.71
Task Completion	16	Fully discussing and reaching consensus on task content	4.27
	17	Actively participating in team tasks	4.14
	18	Managing self-learning plans and progress effectively	4.61
	19	Enhancing problem-solving ability through PBL	4.86
Summary	20	Cultivating independent thinking and teamwork ability through PBL	4.73
	21	PBL teaching has a positive impact on practical learning	4.92
	22	Active participation and diligent learning in the course	4.57

Although the overall feedback on the PBL-integrated design course was highly positive (M = 4.56/5), several lower-scoring items reveal key areas for pedagogical improvement. Notably, "Linking new knowledge with prior learning" (knowledge integration) received the lowest score (M = 3.93), suggesting that while students engaged effectively with PBL activities, they encountered difficulties synthesizing interdisciplinary concepts—particularly between cultural theory (e.g., Hakka symbolism, semiotics) and practical design execution. This disconnect may stem from the course structure emphasizing output-oriented tasks (e.g., prototyping, design rendering) without sufficiently scaffolding the cognitive mapping between conceptual frameworks and design rationale. For example, while students could apply motifs like the yeh-hop flower in product aesthetics, many struggled to articulate how these visual forms embodied deeper cultural values or semiotic logic. Beyond this, low scores in "Learning different expression techniques" (M = 3.71) and "Sharing and discussing collected data" (M = 3.92) indicate a need for enhancing students' communication versatility. This can be addressed through the integration of multimodal presentation formats (e.g., visual storytelling, analogies, narrative-based reports) to support more inclusive and accessible expression of ideas within diverse teams.

C. Cross-Analysis

A cross-analysis of students' professional backgrounds and learning effectiveness showed that full-time students and cultural industry practitioners scored higher in learning content and skills (4.75 and 4.71, respectively), reflecting their sensitivity to creativity and design. Chefs and designers scored higher in teamwork (4.55 and 4.62, respectively), indicating strong collaboration abilities. Public servants had slightly lower scores in task completion and summary (4.32 and 4.65), suggesting they required more time to adapt to the innovative teaching model.

D. Factor Analysis

Factor analysis extracted three main components: a. Learning motivation and problem-solving ability (32.4% variance explained). b. Teamwork and communication ability (27.8% variance explained). c. Design and creative thinking (22.1% variance explained). The cumulative variance explained was 82.3%, showing that the questionnaire focused on these three core factors.

E. ANOVA

ANOVA results showed a significant effect of professional background on learning effectiveness ($F = 5.42$, $p < 0.05$). Post-hoc tests indicated a significant difference in learning motivation between full-time students and public servants ($p < 0.01$). Chefs scored significantly higher than cultural industry practitioners in teamwork ($p < 0.05$). ANOVA results confirmed that students' professional backgrounds significantly influenced learning outcomes ($F = 5.42$, $p < 0.05$). Full-time students showed higher learning motivation than public servants ($p < 0.01$), while chefs outperformed cultural industry practitioners in teamwork ($p < 0.05$). These quantitative findings align with qualitative insights from the design process. Full-time students demonstrated stronger knowledge integration and symbolic interpretation, adapting quickly to PBL. In contrast, public servants needed more time to adjust to open-ended tasks. Chefs, drawing from hands-on expertise, contributed practical solutions in material application and functionality—such as grip comfort and cutting board thickness—enhancing team output and design feasibility. These patterns highlight the complementary strengths of students from diverse backgrounds. However, they also emphasize the need for targeted instructional support—particularly for learners with less experience in theoretical reasoning—to bridge the gap between cultural symbolism and design expression.

F. Discussion

PBL significantly enhanced students' understanding and application of Hakka Flower (*Magnolia coco*) culture. The data indicate strong performance in independent

thinking, critical analysis, and interdisciplinary knowledge integration, particularly in learning content and summary (4.65 and 4.74). Teamwork played a crucial role, helping students gain new insights from diverse opinions. However, some students, especially public servants, showed a learning curve in adapting to PBL, likely due to their professional background. Balancing semiotic interpretation and design innovation remained a challenge, especially in transforming symbolic aesthetics into marketable products. Future improvements include providing more semiotics case studies, increasing interdisciplinary interaction, and strengthening post-class reflection.

G. Learning Effectiveness and Challenges

Students effectively applied ethnography and semiotics, resolving cultural symbol extraction issues. While most exhibited creativity in Hakka Flower (*Magnolia coco*) design, some faced difficulties balancing symbolic interpretation and market demands. Though PBL fostered teamwork, ensuring equitable role distribution remained a challenge.

V. Conclusion

This study applied the PBL model to guide students in integrating ethnography and semiotics into Hakka Flower (*Magnolia coco*) cultural design, resulting in marketable wooden cutting boards. Using semiotic analysis (external beauty, behavioral beauty, intrinsic beauty), students based their creations on the flower's appearance, usage context, and cultural meaning. The final products demonstrated both cultural depth and commercial potential, affirming PBL's effectiveness in merging cultural heritage with design innovation. Future curriculum improvements should emphasize balancing semiotic interpretation and design while enhancing knowledge integration and presentation skills. This study applied the PBL model to guide students in integrating ethnography and semiotics into Hakka Flower (*Magnolia coco*) cultural design, resulting in marketable wooden cutting boards. Using semiotic analysis (external beauty, behavioral beauty, intrinsic beauty), students based their creations on the flower's appearance, usage context, and cultural meaning. The final products demonstrated both cultural depth and commercial potential, affirming PBL's effectiveness in merging cultural heritage with design innovation. Future curriculum improvements should emphasize balancing semiotic interpretation and design while enhancing knowledge integration and presentation skills. Beyond the scope of Hakka culture, this research offers broader implications for design pedagogy. The PBL approach, with its focus on inquiry, collaboration, and real-world problem-solving, can be adapted to explore diverse cultural contexts—such as Indigenous, immigrant, or urban subcultures—by guiding students to investigate local symbols, customs, and narratives. Similarly, the methodology is applicable across various product categories, from wearable accessories and interior objects to packaging and service systems, encouraging culturally rooted yet market-responsive design outcomes. By positioning culture as both inspiration and research material, PBL fosters deeper engagement with identity, ethics, and sustainability in design education. Thus, this model has the potential to cultivate globally aware designers who are capable of transforming intangible cultural values into tangible, context-sensitive products.

Conflict of Interest

The author declares no conflict of interest.

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