

# Fostering Creativity through Project-Based Learning in Chinese Upper-Secondary Arts Schools: A Practice-Informed Mechanism–Context Framework

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## ABSTRACT

Creativity is a central goal of contemporary art education, yet design teaching in some Chinese upper-secondary arts schools remains strongly shaped by technical training, exemplar imitation, and final-product assessment. Such practices can support foundational skills while leaving limited space for problem finding, divergent ideation, autonomous decision-making, trial-and-error, and iterative refinement. This practice-informed conceptual study examines how project-based learning (PBL) may foster creativity in Chinese upper-secondary arts schools. Drawing on recent literature on PBL, creativity, visual arts education, design-based learning, and secondary art education, the paper develops a mechanism–context framework that links five PBL teaching features to five creative learning mechanisms and expected creativity outcomes. The framework proposes that authenticity supports problem finding and reframing; openness supports divergent thinking and multiple-solution generation; inquiry and autonomy support independent decision-making and trial-and-error; collaboration supports perspective collision and idea expansion; and product-feedback cycles support reflection, revision, and iteration. Creativity is conceptualized as a dynamic capability encompassing originality, fluency, flexibility, elaboration, and contextual appropriateness. Teacher scaffolding, psychological safety, formative assessment, and time-space-resource conditions are specified as path-relevant contextual supports, while assessment pressure, curriculum structure, teacher-authority norms, and school culture are treated as hypothesized institutional boundary conditions rather than universal characteristics of Chinese schooling. Three authentic teaching projects—campus poster design, campus wayfinding redesign, and campus IP mascot and merchandise development—are used as illustrative practice examples rather than empirical tests. The study explicitly distinguishes literature-supported claims, author-generated theoretical propositions, and practice-based illustration, thereby clarifying what is empirically grounded and what requires future validation through empirical research in varied school settings.

**Keywords:** project-based learning, art high school, art and design education, creativity, creative learning

## INTRODUCTION

### Background and problem

As education systems increasingly emphasize innovation, higher-order thinking, and competence development, creativity has become an important learning outcome across disciplines. This shift is especially consequential for upper-secondary arts education, where students are expected not only to acquire drawing, color, composition, materials, and media skills, but also to develop visual thinking, aesthetic judgment, creative expression, and cultural understanding. In China, the General Senior High School Art Curriculum Standards (2017 Edition, revised in 2020) explicitly identify creative practice as a core disciplinary competency and call for students to use creative thinking in artistic practice (Ministry of Education of the People's Republic of China, 2020). This policy direction suggests that art education should move beyond asking whether students can complete

technically competent products toward asking whether they can identify problems, generate alternatives, make independent judgments, and revise ideas in response to evidence and feedback.

A persistent instructional tension, however, lies between foundational skill training and creativity development. Teacher demonstrations, exemplary works, repeated technical exercises, and product-based assessment can be valuable for building disciplinary foundations, yet an excessive dependence on predetermined models may restrict students' opportunities to frame problems, explore alternatives, tolerate uncertainty, and learn from failure. The issue is therefore not whether technical training should be abandoned. Rather, the challenge is how to reposition technical knowledge and skills from ends in themselves to resources that students can mobilize when solving authentic design problems.

Project-based learning (PBL) offers a potentially productive response to this challenge. PBL organizes learning around meaningful problems or projects and typically involves inquiry, decision-making, collaboration, production, presentation, and reflection (Farshad & Fortin, 2026; Wijnia et al., 2024; Zhang & Ma, 2023). A meta-analysis by Zhang and Ma (2023) found overall positive effects of PBL on learning outcomes, while Wijnia et al. (2024) reported favorable motivational effects of student-centered problem-, project-, and case-based approaches. At the same time, recent syntheses caution against treating PBL as a uniformly effective intervention independent of design and implementation. An umbrella review by Farshad and Fortin (2026) highlighted substantial variation in the methodological quality and outcomes of PBL research and noted that evidence for creativity remains less settled than claims about PBL sometimes imply. This suggests that the label “PBL” alone cannot explain why creative development occurs.

### **From instructional form to mechanism**

A more useful question is therefore not simply whether PBL fosters creativity, but which features of PBL activate which creative learning processes. Two classrooms may both be described as project-based while offering very different opportunities for creativity. A project in which the teacher specifies the problem, visual form, procedure, and criteria in advance may remain largely an exercise in execution. Conversely, even a relatively small project may create substantial creative learning opportunities if students must investigate a real situation, define the problem, generate multiple possibilities, make meaningful decisions, and revise prototypes through feedback.

This distinction is particularly important in art and design education. Design creativity involves more than producing visually novel outcomes. Design problems are typically open-ended and constrained by users, functions, culture, materials, space, time, and resources. Creativity therefore involves problem reframing, idea generation, comparison, testing, adaptation, and refinement. Recent research in art and design education similarly emphasizes experiential, interdisciplinary, and problem-solving approaches to creative thinking (Oo et al., 2024; Samaniego et al., 2024; Tam, 2023). Samaniego et al. (2024), in a systematic review of creative thinking in art and design education, identified experiential learning, STEAM, and interdisciplinary approaches as prominent directions. Tam (2023) demonstrated that creativity can be deliberately supported through visual arts pedagogy that combines openness, exploration, interaction, and structured activity. Oo et al. (2024) further showed that design-based learning can support creative performance through challenges, criteria, solution development, and testing.

### **Chinese upper-secondary arts school context**

The Chinese upper-secondary arts school context warrants attention because curriculum expectations, disciplinary skill training, school assessment arrangements, and classroom authority relations can shape the space available for open-ended design inquiry. However, these conditions should not be treated as uniform across schools or regions. The national curriculum explicitly emphasizes creative practice and the use of artistic knowledge to solve problems (Ministry of Education of the People's Republic of China, 2020), while emerging Chinese studies of project-based and interdisciplinary art learning emphasize authentic tasks, inquiry, materialized outcomes, presentation, reflection, and iterative revision (Cai, 2022; Wu et al., 2024). On this basis, the present paper treats examination pressure, curriculum structure, teacher-authority norms, and school culture as context-sensitive boundary conditions to be examined rather than as fixed cultural attributes. The key issue is

therefore not whether PBL should replace skill training, but how authentic problems, student decision-making, and iteration can be integrated with disciplinary structure and teacher support in particular school settings.

### **Research questions and contribution**

This paper addresses three research questions: (RQ1) Which teaching features of PBL are most relevant to creativity development in Chinese upper-secondary arts schools? (RQ2) Through what creative learning mechanisms may these PBL features support problem finding, idea generation, design development, and iteration? (RQ3) What contextual conditions may support or constrain the operation of creativity-oriented PBL in Chinese upper-secondary arts education?

The paper contributes in four ways. First, it disaggregates PBL into five pedagogically meaningful features—authenticity, openness, inquiry and autonomy, collaboration, and product-feedback cycles—and links them to distinct creative learning mechanisms. Second, it conceptualizes design creativity as a dynamic capability comprising originality, fluency, flexibility, elaboration, and contextual appropriateness rather than as final-product novelty alone. Third, it differentiates path-specific contextual supports from broader institutional boundary conditions, thereby specifying more clearly how context may shape the operation of particular mechanisms. Fourth, it translates the framework into practice through three authentic art-and-design projects while explicitly distinguishing literature-supported relationships, author-generated theoretical propositions, and illustrative practice examples.

## **METHODOLOGY**

### **Research design**

This study adopts a practice-informed conceptual approach. It is neither an experimental study nor a survey study, and it does not claim to establish statistical causal relationships between PBL and creativity. Instead, the study develops a conceptual mechanism framework through three linked activities. First, recent literature on PBL, creativity, visual arts education, design-based learning, peer learning, and secondary art education was examined to identify recurring concepts relevant to creative learning. Second, these concepts were reorganized around the disciplinary characteristics of art and design learning in Chinese upper-secondary arts schools to construct a three-layer framework of teaching features, creative learning mechanisms, and expected creativity outcomes. Third, three authentic teaching projects implemented by the author were used as illustrative practice examples to show how the proposed concepts can be instantiated in classroom activity. The resulting pathways are theoretical propositions informed by prior research and practice; they are not presented as empirically verified causal effects.

### **Literature selection and conceptual synthesis**

The conceptual synthesis focused on five bodies of literature: (a) PBL and its learning effects; (b) PBL, higher-order thinking, and creativity; (c) creativity in visual arts and design education; (d) design-based learning, collaboration, feedback, and iteration; and (e) Chinese high school art curriculum and project-based art practices. To maintain currency, the review emphasized research published within the past five years while retaining selected foundational and policy sources required to define the educational context. The evidence base includes meta-analyses, systematic reviews, empirical studies, and practice-oriented design education research (Andriyanto & Rahdiyanta, 2025; Buruntong et al., 2025; Cai, 2022; Chen, 2024; Farshad & Fortin, 2026; Ferrero et al., 2021; Kwon & Lee, 2025; Oo et al., 2024; Samaniego et al., 2024; Tam, 2023; Wijnia et al., 2024; Wu et al., 2024; Zhang et al., 2024; Zhang & Ma, 2023). This paper is not a systematic review and does not claim exhaustive database coverage or PRISMA compliance; the literature is used for conceptual integration rather than effect-size estimation.

### **Use and limits of practice examples**

This study draws on three teaching projects actually implemented by the author as illustrative practice examples: campus-themed poster design, micro-renewal of campus wayfinding systems, and the development of campus

IP mascots and derivative merchandise. These projects originated in authentic upper-secondary art and design teaching and included investigation, solution generation, peer critique, presentation, feedback, and revision.

The projects are not treated as stand-alone empirical cases for effect testing. Instead, they function as illustrative practice examples that show how the proposed mechanism–context framework may be instantiated in real classroom practice. Accordingly, the paper does not compare project outcomes or infer causal relationships; it uses the practice material to strengthen the contextual explanatory power and pedagogical operability of the conceptual framework.

### Conceptual definitions and evidentiary status

Three evidentiary categories are used throughout the paper to prevent conceptual and empirical claims from being conflated. First, literature-supported statements summarize findings or arguments reported in prior research and are accompanied by citations. Second, theoretical propositions are relationships synthesized by the authors from the literature and the disciplinary logic of art and design learning; these are signaled by terms such as ‘propose,’ ‘may,’ ‘expected,’ and ‘hypothesized.’ Third, practice illustrations describe how the proposed mechanisms appeared in three authentic teaching projects, but these examples are not used as causal evidence because systematic student-level data were not collected. In this paper, ‘practice-informed’ therefore means that classroom experience is used to refine the pedagogical plausibility and contextual specificity of a literature-grounded conceptual model, not that practice observations substitute for empirical validation. ‘Mechanism–context’ refers to an explanatory structure in which identifiable PBL features are expected to activate creative learning processes, while contextual supports and institutional boundary conditions shape whether those processes can operate. Table 1 makes the evidentiary status of the principal relationships explicit.

| Proposed relationship                                                                            | Literature basis used in this paper                                                                                                                                                                     | Evidentiary status in this paper                                                                                                                                           |
|--------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Authenticity → problem finding/reframing → context-responsive design                             | PBL and design-learning literature emphasizes meaningful problems, inquiry, constraints, and design problem solving (Zhang & Ma, 2023; Oo et al., 2024).                                                | Theoretical proposition; illustrated through the campus wayfinding project; requires empirical testing.                                                                    |
| Openness → divergent thinking/multiple solutions → originality, fluency, flexibility             | Visual arts and creativity research emphasizes open-ended exploration and structured opportunities for creative thinking (Tam, 2023; Samaniego et al., 2024).                                           | Theoretical proposition; supported conceptually by prior research; not tested in this study.                                                                               |
| Inquiry/autonomy → decision-making/trial-and-error → creative agency                             | Student-centered learning literature supports meaningful learner involvement and structured autonomy (Wijnia et al., 2024).                                                                             | Theoretical proposition; practice-informed; causal effect not established.                                                                                                 |
| Collaboration → perspective collision/idea expansion → flexibility                               | Peer-learning design pedagogy highlights open communication, critique, and creative thinking (Chen, 2024).                                                                                              | Theoretical proposition with direct literature support for the collaborative process; outcome pathway requires validation.                                                 |
| Product-feedback cycles → reflection/revision/iteration → elaboration/contextual appropriateness | Design-based learning emphasizes solution development, testing, and revision (Oo et al., 2024).                                                                                                         | Theoretical proposition; illustrated across all three projects; not an empirical mediation test.                                                                           |
| Contextual supports and institutional boundary conditions shape the above paths                  | Curriculum and Chinese project-based art literature establish the relevance of creative practice, authentic tasks, reflection, and iteration (Ministry of Education, 2020; Cai, 2022; Wu et al., 2024). | Boundary-condition hypotheses. School-level variation is expected; no claim is made that assessment pressure, authority norms, or school culture are uniform across China. |

**Table 1: Evidence-to-Proposition Map for the Mechanism–Context Framework**

## **Project-Based Learning in Chinese Art and Design Education**

### **PBL as a set of teaching features**

PBL engages learners with sustained problems or projects through inquiry, collaboration, decision-making, and production (Wijnia et al., 2024; Zhang & Ma, 2023). Zhang and Ma (2023) found positive overall learning effects across experimental and quasi-experimental studies, but contemporary reviews emphasize that outcomes depend on implementation. For this reason, the present study treats PBL not as a single instructional label but as a configuration of teaching features that shape what students are actually required and permitted to do.

### **Alignment with Chinese upper-secondary arts school learning**

Upper-secondary arts education already contains conditions that are compatible with PBL. The Chinese curriculum places emphasis on creative practice, independent learning, collaboration, and the use of varied media to solve artistic and design problems (Ministry of Education of the People’s Republic of China, 2020). Art and design tasks are visual, practical, open-ended, and often multi-solution. Chinese project-based art education studies similarly emphasize authentic tasks, inquiry, presentation, reflection, and iterative improvement (Cai, 2022; Wu et al., 2024). PBL is therefore valuable not because it makes art classes more activity-rich, but because it can reorganize the relationship among disciplinary skills, authentic problems, and student creative agency.

### **Five core PBL teaching features**

#### **Authenticity**

Authenticity refers to a substantive connection between a project and real environments, users, purposes, or problems. In design learning, authenticity changes the structure of the task. Rather than merely asking how to produce a poster, sign, or mascot, students must ask why the design is needed, for whom it is intended, what problem currently exists, and what evidence should guide the solution. Authenticity therefore provides a foundation for problem finding and reframing.

#### **Openness**

Openness means that a project allows multiple legitimate solution paths rather than a single predetermined answer. The multi-solution character of design makes openness especially important. Students can explore different media, visual languages, compositions, narratives, and design strategies. Such openness does not imply absence of standards; instead, it preserves the space required for divergent thinking while maintaining relevant functional and disciplinary criteria.

#### **Inquiry and autonomy**

Inquiry requires students to collect, interpret, and use information, while autonomy concerns meaningful choice and decision-making. In PBL, students may participate in defining sub-problems, choosing design directions, deciding which evidence matters, and determining how to revise a solution (Wijnia et al., 2024). Autonomy is not synonymous with teacher withdrawal. It is better understood as authentic student control over selected design decisions within an appropriately scaffolded structure.

#### **Collaboration**

Collaboration in design learning should extend beyond task division. Its creative value lies in joint problem definition, idea exchange, critique, comparison, and perspective taking. Chen (2024) emphasizes the role of peer learning and open communication in design pedagogy for creative thinking. Collaborative interaction becomes creativity-relevant when students are required to explain, challenge, combine, or revise ideas rather than merely divide production roles.

## **Product-feedback cycles**

Design projects externalize thinking in visible forms such as sketches, models, posters, visual systems, or digital prototypes. Once ideas become visible, they can be compared, tested, and critiqued. Design-based learning research shows that challenges, solution formation, and testing are important components of creative performance (Oo et al., 2024). The educational value of a product is therefore not only that it represents completion, but also that it creates an object through which feedback and revision can occur.

## **Creativity Development in Art And Design Learning**

### **Creativity as a developable capability**

Creativity should not be treated solely as an artistic talent possessed by a small number of students. Contemporary art and design education research increasingly treats creative thinking as developable through structured experience, problem solving, social interaction, and pedagogical intervention (Samaniego et al., 2024; Tam, 2023). Tam (2023), for example, demonstrated that open-ended and exploratory visual arts activities, group interaction, and an appropriate balance of freedom and structure can support creative thinking. This view is particularly important in secondary education because it shifts classroom attention from identifying who is naturally creative to designing conditions in which creative behavior can emerge and develop.

### **Disciplinary specificity of design creativity**

Design creativity has a dual requirement of novelty and appropriateness. A highly novel proposal that does not address users, function, or context is not necessarily a mature design, while an entirely conventional but functional solution may lack sufficient creative value. Design creativity therefore involves working productively within constraints. This process includes reframing the problem, generating alternatives, comparing solutions, testing feasibility, and refining the outcome (Oo et al., 2024; Samaniego et al., 2024). In this paper, creativity in high school art and design learning is defined as the learner's capacity to respond to authentic and open design problems by reframing problems, generating and comparing multiple solutions, experimenting, and iterating toward outcomes that are novel, feasible, and contextually appropriate.

### **Five dimensions of creativity outcomes**

Originality refers to the production of ideas, forms, or solutions that show meaningful difference from routine responses. In design education, originality does not require isolation from precedents; exemplary works should function as analytical resources rather than templates for replication.

Fluency refers to the ability to generate multiple relevant ideas or solution options. Producing several alternatives can prevent premature fixation on the first acceptable idea and provide material for comparison and recombination.

Flexibility refers to the ability to shift perspective or strategy when a design encounters new evidence, constraints, or conflicting requirements. In design learning, flexibility becomes visible when students can change materials, composition, audience assumptions, or problem definitions rather than merely polishing an unworkable initial idea.

Elaboration refers to the progressive development of an initial idea into a more complete and coherent solution. Creativity therefore exists not only in idea generation but also in the detailed work of revision, specification, and refinement.

Contextual appropriateness is included as a distinct dimension because design outcomes must respond to users, function, environment, and culture. High-quality design creativity can therefore be understood as innovation that works within a specific context rather than novelty detached from practical meaning.

## Proposed Mechanism–Context Framework

### Overall logic

The proposed framework contains three analytical layers. The first layer comprises five PBL teaching features: authenticity, openness, inquiry and autonomy, collaboration, and product-feedback cycles. The second layer comprises five creative learning mechanisms: problem finding and reframing, divergent thinking and multiple-solution generation, autonomous decision-making and trial-and-error, perspective collision and idea expansion, and reflection-revision-iteration. The third layer comprises expected creativity outcomes: originality, fluency, flexibility, elaboration, and contextual appropriateness. The framework does not assume one-to-one causal determinism. Instead, the five horizontal paths identify the mechanisms expected to be most directly activated by each PBL feature, while outcomes remain many-to-many and recursive. Four contextual supports are specified at the pathway level: teacher scaffolding is expected to be especially important for openness and autonomous inquiry; psychological safety for trial-and-error and critique; formative assessment for feedback, reflection, and revision; and adequate time, space, and resources for authentic investigation, prototyping, and iteration. Broader institutional conditions—assessment pressure, curriculum structure, teacher-authority norms, and school culture—are treated as hypothesized boundary conditions that may strengthen or constrain these supports in particular schools. These contextual propositions require empirical validation and should not be interpreted as universal descriptions of Chinese education.

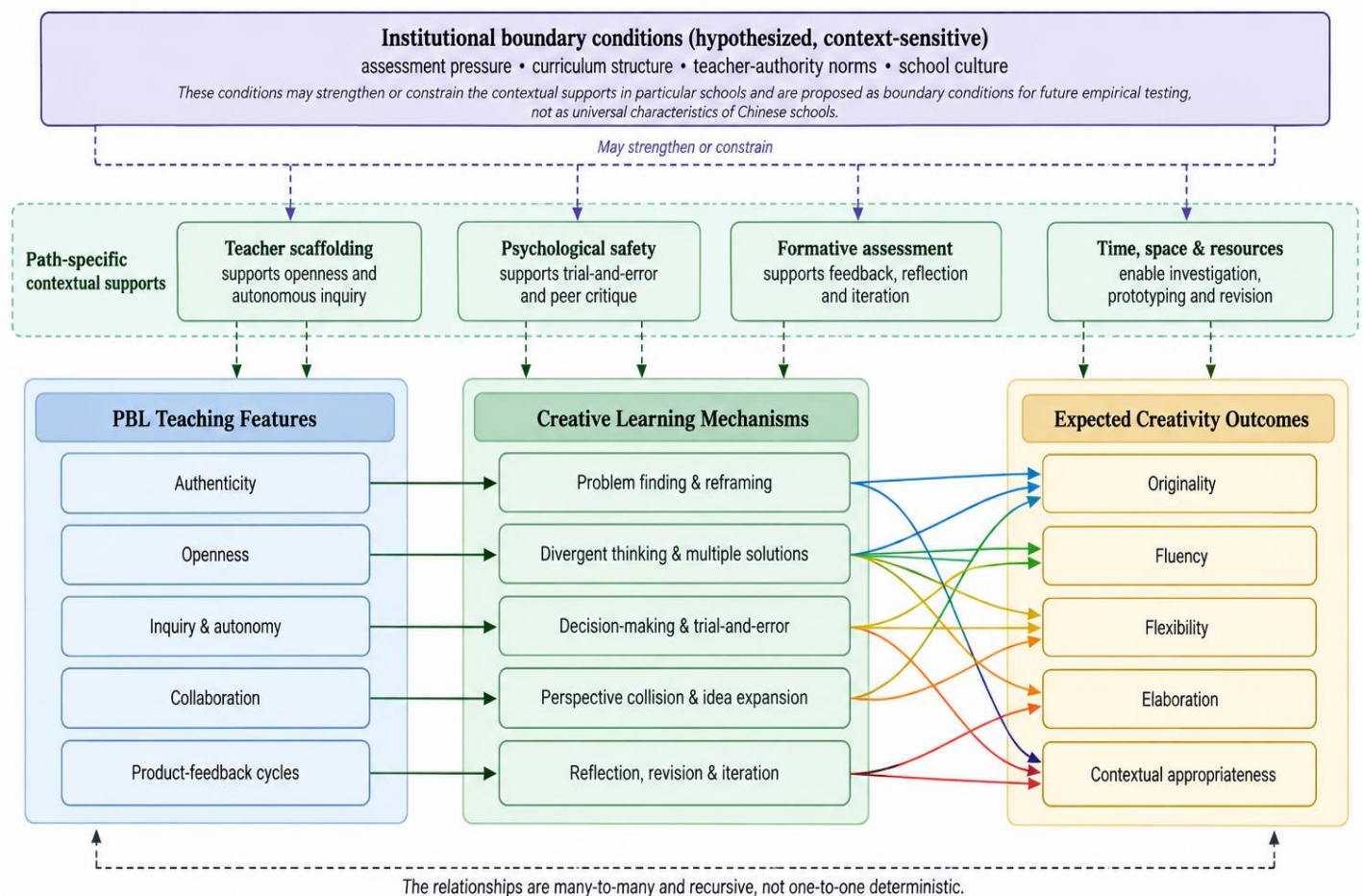


**Figure 1: Mechanism–Context Framework of PBL and Creativity Development in Chinese Upper-Secondary Arts Schools**

### Path 1: Authenticity → problem finding and reframing → contextual appropriateness

Authentic design tasks can require students to work before a problem is fully specified. The proposed mechanism is not authenticity → creativity in a single step, but authenticity → situated information gathering → discrepancy recognition → problem definition/reframing → context-responsive design judgment. PBL and design-learning

research supports the importance of meaningful problems, inquiry, and design constraints (Zhang & Ma, 2023; Oo et al., 2024), while the specific mediated pathway proposed here remains a theoretical proposition. In upper-secondary art and design learning, students may observe an environment, identify user needs, compare the existing situation with desired functions, and decide what is genuinely worth addressing. The expected creative contribution of authenticity is therefore strongest for problem finding, reframing, and contextual appropriateness rather than for novelty alone.

### **Path 2: Openness → divergent thinking and multiple solutions → originality, fluency, and flexibility**

Creativity requires a solution space that is not fully predetermined. The proposed mechanism is openness → generation of non-equivalent alternatives → comparison and recombination → delayed convergence. When visual form, procedure, and answer are specified in advance, students mainly execute; when a project permits alternative interpretations and solution paths, students must generate, compare, and justify possibilities. Tam (2023) provides empirical support for open-ended exploration combined with structured activity in visual arts pedagogy, while Samaniego et al. (2024) identifies experiential and creative-thinking approaches across art and design education. On this basis, the paper proposes that openness primarily supports fluency by increasing the number of relevant alternatives, originality by widening the solution space, and flexibility by requiring shifts among different approaches. These outcome links are expected rather than tested in the present study.

### **Path 3: Inquiry and autonomy → decision-making and trial-and-error → creative agency**

Design activity contains consequential decisions: what problem to prioritize, which medium to use, which concept to retain, whether to accept feedback, and how to respond to constraints. The proposed mechanism is inquiry/autonomy → evidence-based choice → trial-and-error → reflective justification of design decisions. When the teacher makes all key decisions, students may participate in production without participating meaningfully in design. Autonomy is therefore defined here as bounded decision authority over selected aspects of the project, not unrestricted freedom or teacher withdrawal. Wijnia et al. (2024) supports the broader value of student-centered approaches, but the specific pathway from autonomy to creative agency is a theoretical proposition in this paper. Trial-and-error becomes creativity-relevant when an unsuccessful attempt is interpreted as information that triggers a new judgment, rather than merely as an error to be corrected by the teacher.

### **Path 4: Collaboration → perspective collision → idea expansion and flexibility**

The creative value of collaboration lies not in distributing production tasks among group members but in exposing ideas to different perspectives. The proposed mechanism is articulation of an idea → comparison with an alternative perspective → reasoned cognitive conflict → recombination or revision. Chen (2024) provides direct support for the relevance of peer learning and open communication to creative thinking in design pedagogy. Accordingly, collaboration is expected to support flexibility and idea expansion only when students explain, question, challenge, combine, or revise ideas; simple division of labor does not activate the same mechanism. Peer critique therefore becomes most valuable when students must provide reasons, ask questions, and propose alternatives rather than state preferences.

### **Path 5: Prototype-feedback-iteration → reflection and revision → elaboration and contextual appropriateness**

Creative ideas rarely emerge fully developed. The proposed mechanism is idea externalization → multi-source feedback → reflective judgment → targeted revision → renewed testing. Sketches, models, mock-ups, posters, and digital prototypes make ideas visible enough to compare and test. Oo et al. (2024) supports the importance of solution development and testing in design-based learning. The present paper extends that logic by proposing that feedback contributes to creativity only when it changes subsequent design action. This pathway is expected to be especially important for elaboration, because repeated revision develops an initial idea into a more coherent solution, and for contextual appropriateness, because feedback can reveal mismatches with users, functions, environments, or constraints. The pathway is theoretically specified here but not empirically tested as a mediation process.

## **Recursive rather than strictly linear operation**

The five paths are presented separately for analytical clarity, but creative learning is recursive rather than strictly linear. A user test may reveal that the original problem was poorly framed, sending the learner back to problem finding; a peer critique may generate a completely new concept; a material constraint may require a shift in strategy. The framework should therefore be interpreted as a set of core theoretical paths within a cyclical design process, not as a closed one-to-one causal sequence.

## **Contextual support conditions**

The framework distinguishes path-specific contextual supports from broader institutional boundary conditions. First, teacher scaffolding is expected to matter most where openness and autonomy create uncertainty: teachers can clarify disciplinary criteria, model inquiry strategies, and establish milestones without pre-empting student decisions. Second, psychological safety is expected to matter most for trial-and-error, critique, and collaboration because students are less likely to expose incomplete ideas or challenge peers if mistakes and disagreement carry interpersonal costs. Third, formative assessment is expected to matter most for product-feedback cycles because criteria, questioning, and revision-oriented feedback determine whether critique becomes actionable evidence for redesign. Fourth, time, space, and material or digital resources are enabling conditions for authentic investigation, prototyping, user feedback, and repeated iteration. These supports can themselves be shaped by institutional boundary conditions. For example, highly compressed assessment schedules may reduce time for multiple alternatives and revision; tightly specified curriculum pacing may limit project depth; teacher-authority norms may influence how much decision authority or peer challenge is acceptable; and local school culture may influence psychological safety and tolerance for visible failure. These statements are framed as context-sensitive hypotheses, not as empirical generalizations about all Chinese upper-secondary arts schools. Student autonomy is treated as part of the inquiry/autonomy mechanism, rather than as a separate contextual factor, which prevents the framework from conflating learner agency with institutional context.

## **Boundary conditions and scope of contextual claims**

The contextual layer is intentionally bounded in two ways. First, it does not claim that examination pressure, teacher authority, curriculum structure, or school culture operate identically across China. Their intensity and meaning are expected to vary by school type, region, subject specialization, assessment arrangement, teacher, and project. Second, the framework distinguishes a boundary condition from a mechanism: a boundary condition changes the likelihood or strength with which a mechanism can operate, whereas a mechanism describes the learning process through which a teaching feature is expected to influence creative development. Thus, assessment pressure may shorten the time available for divergent exploration; it is not itself a creative-learning mechanism. Teacher-authority norms may affect whether autonomy or peer critique is feasible; they are not equivalent to teacher scaffolding. This distinction keeps the framework testable and avoids attributing broad cultural characteristics to individual classrooms without school-level evidence.

## **Illustrative Practice Examples**

### **Purpose and evidentiary status**

The following examples are not presented as evidence that the framework has been empirically validated. Their purpose is to demonstrate how the mechanisms in Figure 1 can be translated into recognizable classroom design practices and to show why the proposed paths are pedagogically plausible. Descriptions of student tasks, feedback, and revision are therefore practice illustrations. No claims are made about effect size, causal impact, or population-level generalizability. Each project highlights different features of the framework while also showing that authentic PBL generally involves overlapping and interacting mechanisms.

### **Campus poster design**

The campus poster project reframed poster-making from a formal visual exercise into a communication task situated in the school environment. Students developed three differentiated design proposals around the same

theme, compared them through peer critique, and selected directions for further development. Requiring multiple alternatives served to delay early fixation and to make fluency and originality visible in the process. Peer critique introduced different interpretations of audience, emphasis, and visual communication. The posters were subsequently displayed through campus light boxes and electronic screens, allowing students to encounter responses beyond the teacher's judgment and to revise their work. The project therefore illustrates the sequence of openness → multiple-solution generation → originality/fluency, together with collaboration and feedback → reflection → elaboration.

### Campus wayfinding system redesign

The campus wayfinding redesign most clearly illustrates creativity under authentic constraints. Students had to examine actual spaces, identify navigation and information problems, consider different users, and propose site-specific improvements. During the process, students encountered constraints such as limited material budgets and conflicting user needs and responded through strategies such as material substitution and node optimization. These conditions transformed constraints from obstacles into triggers for design judgment. The project therefore illustrates authenticity → problem finding, inquiry and autonomy → decision-making and trial-and-error, and feedback/constraint → flexibility and contextual appropriateness. It also exemplifies the paper's central claim that design creativity is not unlimited novelty but the capacity to find new feasible solutions within real conditions.

### Campus IP mascot and merchandise development

The campus IP project began with the identification and interpretation of school cultural symbols. Students explored how cultural meanings could be translated through form, color, character, and visual language rather than merely designing a visually appealing mascot. The selected concept was then extended into a system of poses, expressions, graphic applications, and merchandise. This shift from a single image to a visual system required elaboration, consistency, and adaptability. Exposure to real school-based audiences further required students to consider recognition and acceptance rather than personal preference alone. The project therefore illustrates cultural-context reframing, open visual transformation, autonomous design judgment, system development, and feedback-based refinement.

### Cross-project mechanism mapping

| Project                    | Salient PBL features                       | Salient creative mechanisms                           | Emphasized creativity outcomes                                    |
|----------------------------|--------------------------------------------|-------------------------------------------------------|-------------------------------------------------------------------|
| Campus poster design       | Openness; collaboration; feedback          | Multiple solutions; perspective collision; iteration  | Originality; fluency; elaboration                                 |
| Campus wayfinding redesign | Authenticity; autonomy; feedback           | Problem finding; trial-and-error; adaptation          | Flexibility; elaboration; contextual appropriateness              |
| Campus IP and merchandise  | Authenticity; openness; autonomy; feedback | Cultural reframing; idea generation; system extension | Originality; flexibility; elaboration; contextual appropriateness |

**Table 2: Mapping of the Three Practice Examples to the Proposed Mechanism Framework**

## DISCUSSION

### Opening the black box between PBL and creativity

The principal theoretical contribution of this paper is to move beyond the global question of whether PBL is effective and to specify how particular PBL features may organize creative learning. Existing meta-analyses generally report positive outcomes for PBL (Kwon & Lee, 2025; Zhang et al., 2024; Zhang & Ma, 2023), yet recent synthesis also shows important variation in methods and outcomes (Farshad & Fortin, 2026). A mechanism-based perspective helps explain why two project-based classrooms may differ markedly in their creative potential. Authenticity, openness, autonomy, collaboration, and iteration must be experienced as actual student learning conditions rather than as labels in a lesson plan.

### Creativity as a process system

The framework also reframes creativity from a final-product judgment to a process system. Problem finding, alternative generation, adaptation, and revision are not merely preparatory steps before creativity appears; they are part of creativity development itself. This position aligns with recent art and design education research that emphasizes experiential, process-oriented, and design-based learning (Oo et al., 2024; Samaniego et al., 2024; Tam, 2023). It also suggests that process traces—problem statements, alternative sketches, prototypes, critique notes, and revision logs—may be as theoretically important as final artifacts in future research.

### Creativity under constraint as a disciplinary feature of design

A further contribution is the emphasis on contextual appropriateness. Design activity differs from entirely free artistic expression because users, materials, space, function, and culture constrain what counts as a successful solution. Constraints can limit options, but they can also stimulate flexibility when learners must reconfigure resources or redefine the problem. Mature design creativity therefore requires both novelty and fitness to context. This disciplinary emphasis helps avoid equating creativity with stylistic difference alone.

### Teacher guidance and student autonomy are complementary

Creativity-oriented PBL should not be equated with minimal teacher guidance. For secondary students, excessive openness can increase uncertainty and cognitive load. The more productive configuration is structured autonomy: teachers define necessary boundaries, disciplinary standards, and milestone supports, while students retain meaningful control over selected design decisions. The teacher's role shifts from deciding what students should do to helping students build reasons for why they choose to do it. This is consistent with the broader evidence that student-centered approaches function best when autonomy is supported rather than abandoned (Wijnia et al., 2024).

### Three tensions in the Chinese upper-secondary arts school context

The framework should be interpreted in relation to three analytically distinct tensions that may arise in particular upper-secondary arts-school settings: skill training versus creative exploration, teacher guidance versus student decision authority, and curriculum/assessment pacing versus project depth. The national curriculum establishes creative practice as an educational goal (Ministry of Education of the People's Republic of China, 2020), while Chinese project-based art studies demonstrate the relevance of authentic tasks, reflection, and iteration (Cai, 2022; Wu et al., 2024). Beyond these documented points, the present paper does not assume a uniform national classroom culture. Instead, it hypothesizes that local assessment schedules can constrain time for alternative generation and revision; local authority relations can shape the feasible level of autonomy and critique; and school culture can shape psychological safety. PBL should therefore not replace foundational training. It should reorganize when and why disciplinary skills are used, so that they function as resources for solving authentic problems. The contextual layer in Figure 1 is consequently part of the explanatory model, but its school-level effects remain an empirical question.

## **Pedagogical Implications**

### **Shift from product tasks to authentic problems**

Teachers can begin projects with an authentic problem rather than a prescribed artifact. Instead of assigning “design a poster,” a teacher might ask what communication problem exists in a school event or public space, who is affected, and what evidence is needed before proposing a visual response. This change moves observation and investigation ahead of production and gives students an opportunity to participate in problem framing.

### **Shift from one-shot completion to multiple solutions, prototypes, and iteration**

Creativity-oriented PBL should deliberately delay early convergence. Students can be required to produce two or three meaningfully different concept directions before moving into high-fidelity production. Low-cost prototypes—thumbnail sketches, black-and-white layouts, paper mock-ups, digital drafts, or simple environmental simulations—should be used to expose problems early. Revision should then be treated as a required design stage rather than optional polishing. Short revision logs can document what changed, why it changed, which feedback was accepted, and which was rejected.

### **Shift from teacher-only evaluation to multi-source feedback and psychological safety**

Feedback can be structured across teacher, peer, user, and self-evaluation sources. Teacher feedback should emphasize questions and professional criteria rather than immediate replacement of student decisions. Peer critique should require evidence and alternatives instead of ungrounded preferences. Where appropriate, authentic users can provide information about recognition, usability, or communication. These feedback systems must be supported by psychological safety: criticism should target the proposal rather than the person, disagreement should be permitted, and revision should be normalized as evidence of design development rather than failure.

### **Shift from result scoring to creative-process assessment**

Assessment should reward the behaviors that a creativity-oriented PBL curriculum seeks to develop. A process-oriented rubric may include problem understanding, evidence quality, diversity of alternatives, design rationale, adaptive change, iteration depth, contribution to critique, and final contextual quality. Student portfolios can retain investigation evidence, early sketches, prototypes, feedback, revision records, and final artifacts. The purpose is not to make assessment more complicated, but to communicate that creative process—not only visual finish—deserves sustained effort.

## **Limitations And Future Research**

This study has several limitations. First, it is a practice-informed conceptual study rather than an experimental, survey, or systematic case study. Although the three projects were genuinely implemented, the available records do not support a systematic reconstruction of student samples, pre-post measures, interviews, artifact coding, or longitudinal observation. The paper therefore cannot infer a causal effect of PBL on creativity.

Second, the five mechanism paths are theoretically proposed rather than empirically verified. Future studies could operationalize the five PBL features and examine whether authenticity predicts contextual appropriateness through problem reframing, whether openness predicts originality and fluency through multiple-solution generation, whether autonomy predicts creativity through design decision-making or creative self-efficacy, whether collaboration predicts flexibility through cognitive conflict and idea recombination, and whether feedback and iteration predict elaboration and contextual appropriateness. Structural equation modeling, process tracing, longitudinal designs, and mixed methods could be used for such validation.

Third, future research should collect richer process data. Investigation records, initial problem statements, alternative sketches, prototype versions, peer and teacher feedback, revision logs, final artifacts, and student reflections could reveal how creative ideas change over time. Such evidence would be especially useful for testing the recursive nature of the framework rather than treating creativity as a single post-project score.

Fourth, the contextual support conditions and institutional boundary conditions require direct investigation. Teacher scaffolding, psychological safety, formative assessment, and resource availability may function as moderators or enabling conditions, while assessment pressure, curriculum structure, teacher-authority norms, and school culture may alter whether particular mechanisms can operate. Their relative influence is currently unknown, and future research should measure them at classroom and school levels rather than infer them from broad cultural categories. Fifth, the framework was developed for Chinese upper-secondary arts schools, so its transferability should be examined across school types, regions, assessment arrangements, and design domains such as visual communication, product design, spatial design, and digital media.

Finally, generative artificial intelligence introduces a new research agenda. AI may expand divergent ideation and accelerate prototyping, but it may also increase dependence on visual templates and weaken student ownership of design judgment. Future studies should examine how AI can be integrated into PBL while preserving originality, evidence-based decision-making, and creative agency.

## CONCLUSION

This paper asked not simply whether PBL can foster creativity in Chinese upper-secondary arts schools, but how it may do so. Drawing on recent research and authentic teaching experience, the study proposed a practice-informed mechanism–context framework linking PBL teaching features, creative learning mechanisms, and creativity outcomes. Authenticity is proposed to support problem finding and reframing; openness to support divergent thinking and multiple solutions; inquiry and autonomy to support independent decision-making and trial-and-error; collaboration to support perspective collision and idea expansion; and product-feedback cycles to support reflection, revision, and iteration. These processes are expected to contribute to originality, fluency, flexibility, elaboration, and contextual appropriateness.

The framework also emphasizes that the mechanisms are recursive and context dependent. Teacher scaffolding, psychological safety, formative assessment, and time-space-resource conditions are expected to shape whether authentic inquiry, autonomy, critique, and iteration can occur meaningfully, while institutional factors such as assessment pressure, curriculum structure, teacher-authority norms, and school culture are proposed as school-level boundary conditions. These contextual relationships are hypotheses for future empirical validation rather than universal claims about Chinese education. For Chinese upper-secondary arts schools, the conceptual implication is therefore not a rejection of technical training. Drawing, color, composition, material knowledge, and visual language remain important disciplinary resources; what changes is their instructional function, as skills become tools that students can mobilize to understand authentic problems, justify design decisions, respond to constraints, and refine ideas.

The educational value of creativity-oriented PBL therefore lies less in whether a classroom contains projects than in whether students experience genuine opportunities to identify problems, generate alternatives, make design decisions, encounter different viewpoints, fail productively, use feedback, and redesign. In this sense, the shift from product completion to creative learning is the most consequential contribution that PBL can make to high school art and design education.

## Ethical Approval

Not applicable. This conceptual and practice-informed study did not collect or analyze identifiable data from human participants and did not report individual student information.

## Data Availability Statement

No empirical datasets were generated or analyzed in this conceptual study.

## Conflict Of Interest

The author declares no conflict of interest.

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