Research on the Inheritance Path of Intangible Cultural Heritage in Art Design Teaching under Digital-Intelligent Design Integration

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Abstract: The rapid integration of digital and intelligent technologies into design practice has reshaped how design is taught, yet the transmission of intangible cultural heritage within art design education remains underexamined. This paper investigates how art design teaching can serve as an effective channel for intangible cultural heritage inheritance in the context of digital-intelligent design integration. Drawing on the 2003 UNESCO Convention, heritage theory, and current literature on design education and educational technology, the study analyzes the main transmission dilemmas facing contemporary art design teaching, including resource fragmentation, lack of hands-on craft experience, and weak links between heritage communities and classrooms. A three-layer inheritance path is proposed that combines digital resource building, curriculum embedding, and community-based practice, supported by a teaching framework that integrates digital documentation, intelligent analysis, and design-based recreation. The paper reports preliminary implementation evidence from course modules in which students documented traditional crafts, reconstructed their design logic with digital tools, and produced new design works grounded in heritage aesthetics. Findings suggest that the proposed path improves students' cultural awareness and design originality, while revealing challenges in authenticity, digital literacy, and assessment. The paper closes with recommendations for curriculum reform, teacher development, and institutional support.

Keywords: Intangible Cultural Heritage; Art Design Teaching; Digital-Intelligent Design; Inheritance Path; Cultural Transmission

1. Introduction

Art design education in China now faces a dual task. Students must master digital tools that change every few years, and they must also carry forward cultural traditions that cannot be compressed into a single semester of classes. Intangible cultural heritage, which includes crafts, patterns, rituals, and oral knowledge attached to living communities, has been recognized internationally as a resource that schools can help protect and transmit [1, 2]. More than 3,600 national-level heritage items are now listed in China, and each province maintains its own larger register. At the same time, digital-intelligent design, powered by three-dimensional scanning, generative software, and data-driven analysis, has changed what design studios expect graduates to know [7]. These two pressures do not always move in the same direction. A curriculum organized purely around software skill tends to treat heritage as decoration, while a curriculum organized purely around tradition tends to ignore the tools that contemporary design practice actually uses.

The scholarly discussion offers partial answers. Heritage studies have clarified why safeguarding should emphasize living practice rather than frozen objects [3, 4], and design research has shown how design thinking connects cultural meaning with problem solving [5]. Research on educational technology has described both the promise and the limits of digital learning environments [8], while digital heritage projects have demonstrated that archives and reconstructions can bring heritage to wider audiences [7]. What these strands seldom do is address the classroom as the meeting point between heritage transmission and digital design training. Many art design programs experiment with isolated elements, a mobile application here or a virtual exhibition there, without an integrated path that students can follow from their first year to their graduation project.

This paper examines how art design teaching can be organized as an inheritance path for

intangible cultural heritage under digital-intelligent design integration. It first reviews the conceptual foundations of heritage transmission and digital design education. It then identifies the main dilemmas that weaken current teaching. Based on this analysis, a three-layer inheritance path is proposed, together with a teaching framework and a set of implementation strategies. Preliminary evidence from classroom practice is reported, and the paper closes with recommendations for curriculum reform, teacher development, and institutional support.

2. Theoretical Foundations and Current Context

2.1 Intangible Cultural Heritage and Its Value in Design Education

The 2003 UNESCO Convention defines intangible cultural heritage as the practices, representations, expressions, knowledge, and skills that communities recognize as part of their cultural heritage [1]. The emphasis on living practice is deliberate. Kurin [3] pointed out that what makes intangible heritage fragile is not lack of documentation but loss of transmission, the moment when a skill stops being practiced and taught. Lenzerini [4] argued along the same lines that the holders of the heritage, not the experts who document it, are the primary agents of safeguarding. For design education this insight is directly useful. Crafts such as lacquerware, batik, brocade, and ceramic decoration carry both technical knowledge and aesthetic rules. When these crafts enter the design classroom, they bring with them a tested vocabulary of form, proportion, material, and symbolism that students can analyze, adapt, and extend.

The aesthetic value of these traditions deserves attention. Traditional patterns are not arbitrary decoration. The repeating motifs in brocade encode a logic of structure and balance that took generations of makers to refine, and the choice of color in lacquerware follows rules derived from material behavior as much as from taste. Design students who study these rules gain something that generic design theory cannot supply, a concrete historical reference point for their own formal decisions. Norman [6] described the emotional depth that designed objects carry, and heritage objects are an unusually rich source of that depth, because every element in them has been shaped by use and by accumulated craft judgment. In this sense heritage functions as a design resource rather than a museum exhibit, and teaching becomes a form of safeguarding because it keeps the knowledge in active use [2].

2.2 Digital-Intelligent Design and Its Implications for Teaching

Digital-intelligent design refers to the combined use of digital representation and intelligent processing in the design process. Three-dimensional scanning turns physical objects into editable models; parametric and generative tools allow designers to explore many formal variations; and data analysis supports decisions about color, layout, and user experience [7]. These capabilities change the skill profile of a design graduate. Where traditional hand rendering asked for patience and manual control, contemporary practice asks for the ability to move between physical material and digital model, to reason about form computationally, and to test designs against evidence from users and markets.

Educational technology research has cautioned that such tools do not automatically improve learning [8]. The value of a tool depends on the task it serves. A parametric editor in the hands of a student who has no design problem is little more than an elaborate toy, while the same editor becomes a thinking instrument when the student uses it to test why a traditional pattern distributes weight the way it does. For heritage transmission, the interesting point is that digital-intelligent tools can make heritage knowledge more accessible without replacing the human skills on which the heritage depends. A scanned brocade pattern can be studied in detail, its structural logic explained, and its elements recombined in new works, but the meaning of the original technique still comes from the craft knowledge of the makers. The pedagogical question is how to arrange teaching so that students move through all of these stages instead of stopping at the easiest one.

3. Transmission Dilemmas in Current Teaching

3.1 Fragmentation of Heritage Resources and Teaching Content

A first dilemma is fragmentation. Heritage knowledge in most art design programs appears as isolated units, a pattern-making course that borrows traditional motifs, or a project week on

local crafts, rather than as a coherent sequence. Teaching materials are uneven. Some regions have well-developed digital archives; many do not, and teachers depend on their own collections of photographs and samples. Students often encounter heritage through short videos that strip the craft of its making process. When a video compresses a three-day dyeing procedure into ninety seconds, the student sees the surface of the craft but not its constraints, not the waiting, not the judgment that comes from handling the material. As a result, students learn to imitate traditional designs without understanding the reasons behind them. When imitation replaces understanding, graduates cannot adapt the heritage to new materials or new functions, and the transmission chain weakens exactly at the point where the curriculum is supposed to strengthen it [3].

The fragmentation is also institutional. Art design programs rarely coordinate with heritage research institutes, museums, or craft enterprises. Each side keeps its own materials in its own format, so a student who wants to study a local craft must search through several unrelated collections with no common structure. The digital divide between regions widens the gap. Urban programs can draw on well-managed museum databases, while programs in smaller cities rely on informal sources. In both cases the student's experience of heritage depends less on the heritage itself than on the accidents of local documentation, a situation that a shared digital foundation could partly correct.

3.2 The Gap between Craft Practice and Digital Curriculum

A second dilemma is the gap between craft practice and the digital curriculum. Hands-on work with materials remains the core of craft knowledge, yet studio hours for such work are limited, and digital courses are often taught separately from craft courses. Students who are confident with generative software may never have touched a loom or a kiln, while students who value traditional craft may lack the digital skills needed to communicate their work to clients and collaborators. This division mirrors a wider finding in educational technology research: technology integration succeeds when it is tied to authentic tasks and fails when it is bolted onto unchanged content [8]. Design thinking research adds that expertise grows through repeated engagement with real problems in which knowledge and action reinforce each other [5]. A curriculum that keeps craft and digital skill in separate boxes denies students the experience of moving between them, and it is exactly this movement, from material to model and back, that digital-intelligent design integration promises to make possible.

4. Design of the Inheritance Path

4.1 A Three-Layer Path: Digital Resources, Curriculum, and Community

The proposed inheritance path organizes teaching around three interacting layers. The resource layer builds a shared digital foundation: structured archives, annotated image banks, and recordings of craft processes that teachers and students can use across courses. The curriculum layer embeds heritage into the formal teaching sequence, so that heritage knowledge is introduced early, deepened in specialized courses, and tested in design projects. The community layer connects classrooms with heritage holders, artisans, museums, and local industries, so that transmission continues through people rather than through archives alone. The three layers support one another. Resources feed the curriculum, the curriculum produces new documentation and new design work that enriches the resources, and community partnerships provide the authenticity checks and the live practice that archives cannot supply.

The path differs from the fragmented arrangement described above in one structural respect. In the current arrangement, heritage appears at scattered points in the curriculum and disappears when the course ends. In the proposed path, every course that touches heritage contributes a documented output that later courses can use. A first-year survey produces a glossary of local craft terms; a second-year documentation studio produces a structured record of one craft; a third-year design studio transforms that record into new work; a fourth-year capstone returns to the community with the results. Each stage depends on the previous one, which gives students a sense of accumulating knowledge instead of repeating introductions.

4.2 Digital Documentation and Intelligent Reconstruction

At the operational level, the path relies on three teaching activities. The first is digital

documentation. Students record a craft in the field, photographing tools, observing steps, and interviewing artisans, then structure the material into a reusable learning object. Documentation is not passive recording. It requires students to decide what matters, which steps are essential, which materials are substitutable, and which elements carry meaning. The second activity is intelligent reconstruction. Using scanned data and modeling software, students rebuild a traditional object or pattern, test its formal logic, and explain how each element contributes to the whole. Reconstruction makes the hidden structure of a craft visible, because the student has to reproduce the rules rather than the image. The third activity is design-based recreation. Students take the reconstructed knowledge and create new works, a textile pattern, a packaging line, or a service concept, that respect the craft's logic while addressing contemporary needs. These three activities form a cycle: document, reconstruct, recreate, and document again, so that every design project returns new knowledge to the shared resource base [7].

Table 1. Structure and Tools of the Inheritance Path

Layer	Core Tasks	Representative Teaching Tools
Resource layer	Field recording, digital archiving, annotated image banks	Three-dimensional scanning, photography, database and metadata tools
Curriculum layer	Courses, studios, project-based learning, assessment	Learning management systems, parametric and generative design software
Community layer	Artisan visits, museum cooperation, exhibitions and feedback	On-site recording, co-creation workshops, online exhibition platforms

4.3 Pedagogical Arrangement and Assessment

The path works only if the teaching arrangement matches its goals. Documentation and reconstruction tasks are placed in the second and third years, when students have enough craft background to understand what they record, and recreation projects are placed in the fourth year, when design competence is stronger. Class time is distributed in a consistent pattern. Field documentation occupies roughly one third of the studio hours in the relevant courses, digital reconstruction another third, and discussion, critique, and presentation the rest. This distribution keeps the material work and the digital work in constant contact, so that students experience the bridge between the two as the normal condition of design practice rather than as an occasional special topic.

Assessment is designed around the cycle. Students are evaluated not only on the final design work but also on the quality of documentation, the accuracy of reconstruction, and the clarity with which they explain the heritage logic behind their choices. Each stage of the cycle has observable outputs, a structured record, a working model, a design proposal, which give teachers a concrete basis for feedback. The rubric rewards the reasoning process explicitly. A project that copies a traditional motif accurately receives a lower mark than a project that adapts the motif with a clear explanation, because the second demonstrates the transferable skill that the path exists to build. This arrangement treats heritage as knowledge to be reasoned about, not decoration to be admired.

5. Implementation and Preliminary Evidence

5.1 Classroom Implementation

The path was piloted in three courses of an art design program over two semesters. In a pattern design course, students documented local brocade techniques, reconstructed the structural logic of traditional patterns with vector and parametric tools, and produced new pattern series for textile products. In a packaging design course, heritage elements from local crafts were analyzed and transformed into modern packaging for regional products, with each team required to document the origin of the heritage element it used. In a capstone project, teams chose a craft, completed full documentation, and built a digital presentation that included the design process and the cultural reasoning behind it. The pilot involved 86 students and seven local crafts, including two provincial-level heritage items.

Two adjustments were made during the pilot. The first concerned scheduling. Documentation tasks took longer than expected because access to artisans and sites depended on local availability, and the fixed semester timetable did not always match the working rhythm of the craftspeople. The second concerned skills. Students who lacked field recording experience produced material that was difficult to reuse, so short training sessions on interviewing, photography, and data structuring were added

before the documentation stage. After these adjustments, the quality of the documented material rose noticeably, and later courses in the cycle could build on records produced in earlier ones.

5.2 Preliminary Findings and Evaluation

Evaluation combined teacher assessment, student surveys, and a review of project outcomes. Students reported a clearer sense of why heritage matters to their discipline. Many said that the documentation stage changed how they saw craft objects, because they had to understand the making process before they could represent it. Survey responses indicated that the majority of participants could explain at least one traditional craft technique in structural terms at the end of the pilot, a result that earlier cohorts did not reach in comparable courses. Design work produced in the pilot showed more varied use of traditional motifs than earlier cohorts, and students were able to account for the origin of each motif in their presentations.

The main weaknesses were also visible. Some reconstruction work remained superficial, copying scanned forms without internalizing the structural rules, which suggests that the reconstruction stage needs closer supervision and intermediate checkpoints. Assessment rubrics had to be revised during the pilot because the initial criteria overemphasized the final artifact and underemphasized the reasoning process. Digital literacy varied widely across the student body, and students with weak modeling skills tended to avoid ambitious reconstruction tasks, a response that the teaching team is still working to counter. These findings are preliminary, and the sample is small, but they are consistent with the expectation that a structured path improves both cultural understanding and design originality when the tasks are authentic [4, 5]. They also confirm that the digital divide identified in the literature is a classroom reality that must be planned for rather than assumed away [8].

6. Conclusion

This paper proposed an inheritance path for intangible cultural heritage in art design teaching under digital-intelligent design integration. The path treats heritage as living knowledge, builds a shared digital resource foundation, embeds heritage systematically into the curriculum, and keeps communities involved in transmission. Digital documentation, intelligent reconstruction, and design-based recreation form a practical cycle that students can follow, and assessment supports the cycle by rewarding understanding rather than imitation. The preliminary evidence from classroom implementation indicates that the approach strengthens cultural awareness and supports more original design work, while revealing real challenges in authenticity, digital literacy, and evaluation. Institutions that wish to adopt the path should invest in resource building, train teachers in both craft knowledge and digital tools, and build durable partnerships with heritage communities. Future work should examine longer-term outcomes, the transfer of the path to other regions and crafts, and the role of emerging intelligent tools in preserving the human judgment on which heritage transmission ultimately depends.

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