Digital exploration of ceramic culture inheritance and innovation -- Taking Taoyu APP as an example

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Abstract: The proposal of the national "Digital China" strategy promotes the deep integration of traditional culture and digital technology. As an important carrier of Chinese civilization, the inheritance of ceramic culture faces practical challenges such as the discontinuity of intangible cultural heritage skills and the weakening of young people's cognition. This study uses the Taoyu APP as a practical carrier to explore innovative paths for digital technology to empower the inheritance of traditional culture. By integrating short video learning, 3D interactive display, blockchain certification, and community ecosystem construction.

Research on the empowering role of digital technology in the dissemination, experience, and industrial transformation of traditional ceramic culture, combined with case analysis, proposes a practical plan to achieve cultural resource activation, user interaction innovation, and industrial ecological reconstruction through mobile application platforms.

Keywords: Ceramics: Digitalization: Cultural Communication

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1.Current Status and Challenges of Ceramic Culture Inheritance

Ceramic culture, as a treasure of Chinese civilization, embodies the inheritance of a thousand years of civilization and the crystallization of the spirit of craftsmen, vividly interpreting the craftsmanship inheritance and wisdom accumulation of the Chinese nation. However, with the changes in modern lifestyles, the inheritance of traditional ceramic culture faces severe challenges: on the one hand, the aging problem of intangible cultural heritage inheritors is becoming increasingly prominent, and many traditional skills are at risk of being lost; On the other hand, the younger generation's understanding of ceramic culture is gradually fading, and the gap between traditional craftsmanship and modern life is becoming increasingly apparent. In this context, the rapid development of digital technology has provided new possibilities for the inheritance and innovation of ceramic culture. Taoyu APP takes digital means as its core, integrating ceramic historical knowledge, modern craftsmanship display, interactive learning, and community communication functions, aiming to build a digital platform of "cultural dissemination practice participation value transformation".

1.1 The Value and Historical Status of Ceramic Culture

1.1.1 Core Values of Ceramic Culture

(1) The living continuation of historical value: Ceramics are the key physical evidence for decoding Chinese history. Diversified expression of artistic value: Ceramic art is a condensed expression of traditional Chinese aesthetics. Global radiation of technological value: Chinese ceramic technology has long led the world's materials science revolution.

1.1.2 Contemporary Significance of Ceramic Culture

(1) Cultural Inheritance and Historical Memory: Ceramic culture, as an important component of human civilization, carries the memory of history and the context of civilization. (2) The inheritance of traditional skills: Ceramic production involves a series of complex and exquisite traditional techniques, such as making blanks, decorating, firing, etc. (3) A bridge for cross-cultural communication: Chinese ceramics, as a synonym for "China", is a cultural symbol with worldwide influence, widely spread and recognized in different countries and regions. (4) Innovative activation of industrial ecology: The digital transformation of ceramic culture has given rise to new driving forces in the industry. (5) Ecological wisdom of traditional craftsmanship: sustainable practice models in

ancient porcelain industry.

1.2 Realistic difficulties in the inheritance of ceramic culture

1.2.1 Fault in inheritance subject and loss of skills

Analysis of the survival mechanism of traditional craftsmanship: The intergenerational dilemma and structural challenges of craftsmanship inheritance are fundamentally rooted in the intergenerational succession of the inheritors. However, the current talent pool shows a significant trend of discontinuity. Data shows that the national level intangible cultural heritage inheritors generally exhibit aging characteristics, and the institutionalized mentorship mechanism is not yet sound.

1.2.2 Single mode of cultural dissemination

(1) Structural constraints on the dissemination path of ceramic culture: analysis of the dependence mode of physical space and its radiation effectiveness. The current communication system still adheres to the dominant paradigm of physical venues, and there are significant efficiency bottlenecks in the cultural outreach dimension, manifested as a dual constraint effect:

Firstly, the spatial agglomeration effect leads to an imbalance in cultural accessibility. The core cultural resources present a centralized distribution pattern of production areas, with traditional production areas such as Jingdezhen and Dehua occupying an absolute dominant position. Taking the ceramic collection system of the Palace Museum as an example, although there are 360000 rare ceramic relics (data source: Beijing Cultural Development Statistical Bulletin), the annual on-site visitors are about 19 million, of which the proportion of cross regional cultural consumers is less than 30%, reflecting the contact barrier of non production area audiences.

Secondly, the cost of participation constitutes a barrier to cultural dissemination. Traditional communication scenarios require audiences to complete physical displacement and specialized time planning, forming multidimensional barriers to participation. Museum visits or workshop experiences require coordination of transportation, accommodation, and time costs, which creates a significant mismatch between this complex investment and the daily cultural consumption habits of the public, objectively suppressing their sustained participation momentum.

1.2.3 Insufficient industrial innovation capability

(1) The homogenization of products and the lack of design are serious in ceramic products, which lack original design and cultural added value, leading to a vicious cycle of price war in market competition: antique porcelain dominates the market: most of the products of small and medium-sized ceramic enterprises are antique porcelain or decal daily porcelain, with similar designs and single craftsmanship.

(2) Lack of collaboration and resource waste in the ceramic industry chain, such as design, production, and sales, leads to resource waste and low efficiency. The disconnect between the design and production ends is due to the lack of communication platforms between designers and craftsmen, and many creative designs cannot be realized due to process limitations.

(3) Insufficient brand building and internationalization capabilities. The branding and internationalization level of the ceramic industry is relatively low, making it difficult to form a competitive advantage in the international market. Weak brand awareness: Many ceramic companies lack brand building awareness, and their products are often named after "origin+category" (such as "Jingdezhen Blue and White Porcelain"), making it difficult to form a unique brand recognition.

2.Analysis of Innovation in Digital Inheritance

In the transformation of cultural heritage dissemination mechanisms, the traditional institutions' ceramic culture interpretation system has long relied on physical displays and one-way interpretation modes within the physical space. This linear communication architecture has dual constraints: firstly, the interaction dimension between

exhibits and audiences is limited to visual observation and text reading, resulting in limited cultural decoding efficiency; Secondly, the knowledge transmission process lacks dynamic adaptation of individual cognitive characteristics, resulting in a threshold effect on cognitive conversion rate.

In response to the above-mentioned communication efficiency bottleneck, Taoyu APP has built an immersive cognitive system based on IoT sensor networks and mixed reality technology.

2.1 Innovation in the Dimension of Knowledge Dissemination

(1) Multimodal interactive design: Taking the five famous kilns of the Song Dynasty as an example, users can observe the cross-sectional structure of Ru kiln sky blue glaze through the 3D cultural relic disassembly function, and adjust the virtual kiln parameters independently with the firing temperature simulation tool to view the glaze color changes in real time. This interactive process of "observation experiment verification" transforms users from bystanders to practical participants.

The dynamic knowledge graph integrates academic materials and user behavior data. For example, after users view Ming Dynasty blue and white porcelain, the system automatically pushes AR real-life navigation of Jingdezhen Imperial Kiln Site and associates it with interactive maps of the Maritime Silk Road trade route, achieving cross temporal and spatial knowledge linkage.

(2) Community driven UGC production: Establish a "firing failure case library", where users can upload photos of defects in their works (such as cracked glaze and deformed body), and craftsmen and enthusiasts in the community can jointly analyze the reasons and propose solutions, forming a collaborative learning ecology of "problem discussion improvement".

The live streaming and microphone function breaks down the communication barriers between experts and users. For example, when intangible cultural heritage inheritors demonstrate the technique of separating blue and white water in real time, viewers can ask questions through bullet comments and receive immediate feedback. The live streaming clips automatically generate short videos of skill points for users to learn repeatedly.

(3) Gamified learning mechanism: Design the "Ceramic Craft Challenge" task, where users need to complete glaze ratio experiments, pattern copying challenges, and other levels to unlock advanced courses and virtual badges.

2.2 Value of Industrial Ecological Reconstruction

Through technological empowerment and model innovation, Taoyu APP reconstructs the value chain of the ceramic industry and systematically solves the long-standing problems in the traditional market

(1) Pain point one: Lack of ownership confirmation system and quality traceability dilemma

Ceramic products adopt distributed ledger technology to achieve full lifecycle tracking, and each work is bound with a unique digital ID card (NFT certificate) with a timestamp. This voucher stores records of mineral traceability data, process characteristic parameters, etc. Taking purple clay ware as an example, through a multimodal data retrieval protocol, for example, when consumers purchase purple clay pots, they can scan the code to obtain the detection report of the rock layer in Zone D of the Huanglongshan mining area, 3D scan data of the pot maker's biometric fingerprint, and restore the kiln temperature curve during the firing stage.

A simple ceramic identification model, after users upload spectral images, the system compares the microstructure of glazed surface cracking and the distribution of matrix pores with a database to generate a preliminary analysis report. However, the report is for reference only and cannot completely replace laboratory XRF composition testing.

(2) Pain point 2: From weak cultural perception to knowledge driven consumption decisions driven by the design of a learning and consumption chain: Users need to complete basic ceramic courses (such as "A Brief History of Blue and White Porcelain"). All users can learn ceramic knowledge from different dynasties for free. When users have a certain level of basic knowledge, they have a certain ability to self analyze ceramic appreciation or ceramic

buying and selling. The only open condition for the mall is to complete basic ceramic learning.

(3) Scenario based consumer experience: Using WebGL technology to achieve 360 ° seamless viewing of products, as an advanced 3D display technology, users can freely view the details of products according to their own needs, providing users with an immersive experience of viewing products, etc; Supports 3x digital magnification function, allowing users to observe professional details such as glaze cracking texture and bottom foot repair marks. For example, the Zisha teapot appreciation interface provides a "micro model of clay particle distribution", combined with the Yixing Huanglongshan ore source map, to visually display the material characteristics and regional craftsmanship correlation.

2.3 Ceramic Appreciation and Learning System

The ceramic appreciation and learning system uses video as the core carrier and combines existing mature technologies to construct a practical and popular digital learning framework. The system integrates video course resources with clear grading, gradually progressing from beginners to majors, to meet the needs of different users. The entry-level course mainly consists of 3-5 minute short videos, which explain basic knowledge such as ceramic shape classification and glaze color recognition through a combination of animation and real-life scenarios. The advanced level course is recorded by intangible cultural heritage inheritors in real-life situations, fully showcasing 72 traditional processes such as drawing and shaping, and supporting double speed playback and key step loop viewing; Professional level courses can collaborate with institutions such as the Palace Museum to launch in-depth content such as "The Five Great Kilns of the Song Dynasty" and "The History of Yuan Blue and White Trade", with bilingual subtitles, covering learning groups both domestically and internationally.

3.Functional Architecture Design of Taoyu APP

The cultural dissemination system of Taoyu APP has built a multidimensional and immersive platform for the inheritance of ceramic culture through three core modules - ceramic appreciation and learning, ceramic community and circle, and ceramic digital mall. The aim is to activate the vitality of traditional ceramic craftsmanship through digital means, while meeting the learning and interactive needs of modern users. The following provides a detailed explanation of the implementation logic and innovative value of each module from the perspective of functional design:

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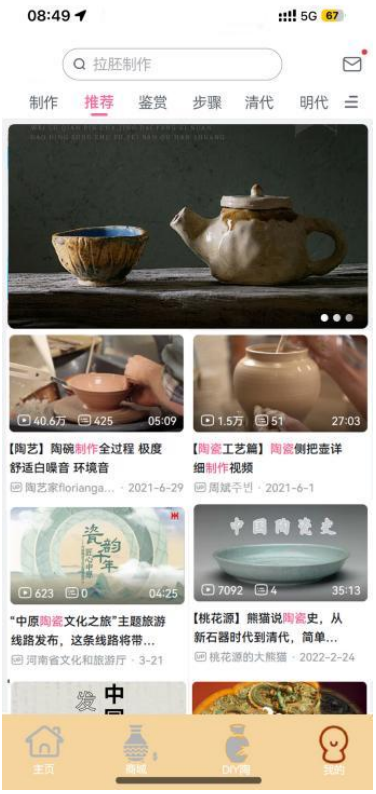
Innovative value: Breaking the traditional model of "one-way indoctrination" and transforming users from passive receivers to active explorers through the interactive chain of "observation disassembly experiment".



3.1 Product Dynasty Differentiation (Image Source: Produced by the Author)

During the learning process, users can ask real-time questions or express their opinions through bullet comments. The system automatically categorizes high-frequency questions and regularly invites experts to live stream answers, forming a dynamically updated knowledge base. Each video course is equipped with a graphic and textual note taking function, allowing users to annotate key content and easily export and share it with the community, exchanging learning experiences with other enthusiasts. To enhance practical abilities, some craft teaching videos are linked to offline experience course reservation entrances. After watching "Manual Craftsmanship Techniques", users can be redirected to the practical course page of nearby pottery workshops, achieving a seamless connection between "online learning and offline practical operation".

3.2 Ceramic Community and Circle

The ceramic community and circle are linked by interests and technological empowerment, building a digital ecosystem that combines cultural depth and social vitality. Users can join sub theme circles such as "Blue and White Porcelain Appreciation", "Chai Kiln Firing Techniques", and "Modern Ceramic Art Creation" according to their preferences. Each circle has three core sections: dynamic sharing, Q&A assistance, and event gathering, forming a vertical communication space. In the dynamic section, users can post high-definition videos of self-made ceramic works and write craft exploration diaries. The content is recommended by algorithms to the homepage of fellow enthusiasts. Works with high likes and comments automatically enter the first page, and creators receive traffic exposure and certification marks. At the same time, it can also enhance user stickiness.

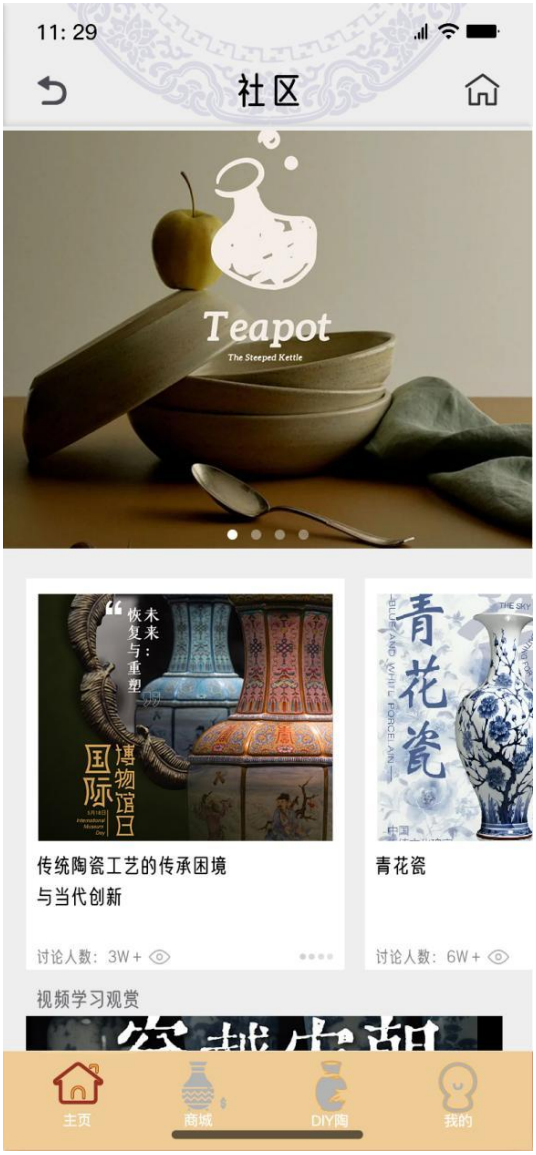


Figure 3.2 Taoyu APP Community Part (Source: Author's Production)

4.Conclusion

Digital exploration not only opens up new paths for the contemporary survival of ceramic culture, but also demonstrates the vitality of traditional culture in the digital age - technology will ultimately serve humanity, and the core of culture will remain fresh through innovation. This practice provides replicable experience for the digital transformation of other intangible cultural heritage, and also contributes Chinese wisdom to the global protection and sharing of cultural heritage.

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