Shiwan Kiln Earthenware Pot Innovation through the Integration of Traditional Kiln Making, Modernity, and Material

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Abstract

The Shiwan kiln, famous for its earthenware, is one of China's intangible cultural heritages due to its aesthetic value and rich traditional production techniques. However, the pots' design has remained the same, diminishing their appeal to younger generations. The objectives of this study were: 1) to analyze Shiwan kiln earthenware pots and how design can be used to foster innovation; 2) to synthesize innovative design directions that reflect a harmonious blend of tradition and modernity; and 3) to apply the new knowledge and create a new set of Shiwan kiln earthenware pots. Using a mixed-methods research methodology, the qualitative research investigated potential areas of innovation, including materials, methods, functions, shapes, culture, and values. Data were collected through participant observation and qualitative interviews. Quantitative methods were used to evaluate the exhibitions and seminars, and quantitative data was collected. It was found that using lithium phosphate instead of quartz sand in the traditional firing process enhanced the pot's strength and prolonged its service life. Based on the innovation of new appearance design, this study produced 68 pottery products, which improved convenience and re-attracted the attention of young audiences to Shiwan kiln pottery pots. A questionnaire survey was conducted among 300 participants, including exhibition visitors, seminar attendees, and ceramic market consumers. The respondents appreciated the cultural craftsmanship of the pots and suggested integrating traditional and modern designs. This study interviewed six ceramic experts, five intangible heritage scholars, and two marketing experts, providing insight into ceramic innovation. They agreed that the fusion of traditional and modern elements underpins this

innovation, ensuring the ceramic tradition's continuity. These new products integrate traditional techniques with modernity, reviving youth interest in Shiwan kiln earthenware pots.

Keywords: Shiwan kiln earthenware pot; Traditional craftsmanship; Ethnography; Intangible cultural heritage innovation

Introduction

The production of the kiln dates back to the Tang and Song dynasties. It developed significantly during the Ming and Qing dynastie (Wenjin, 2017a; Yanjuan, 2011). Its primary product is culinary utensils made of pottery, and it has become a vital production kiln in the nation (Wenjin, 2017b). Shiwan kiln, along with Yixing and Pingding, is referred to as one of the "Three Unique Kilns" and "Shiwan tiles are the best in the world," which demonstrates its central role in stoneware (Dajun, n.d.; Wenjia, 2020). In the 1950s, Shiwan kiln became a state-owned enterprise and adopted an industrialized production paradigm (Xinliang, 2019). With the exception of the use of ceramic pots for cooking Chinese medicine, industrial products such as aluminum and stainless steel progressively replaced the majority of the market for pottery pots beginning in the early nineteenth century, allowing pottery pots to retain a certain market share. Nonetheless, we cannot overlook the fact that pottery pots, as the primary product of the Shiwan kiln, have undergone centuries of evolution and accumulated distinct craftsmanship and rich cultural value (Naishen et al., 1980). There are also clay pots with health-preserving properties because the pottery pot materials do not contain harmful substances, can filter water (Deer et al., 2013), and can enhance the flavor of water (although the effect of enhancing taste is primarily based on traditional experience and lacks detailed scientific support). In recent years, however, this conventional water heating device has confronted a crisis of marginalization in modern society due to its singular design, shoddy construction, lack of durability, and inconvenient use (Yunchuan, 2007) (Figure 1).

Traditional Shiwan Kiln Pottery: Shapes, Sizes, and Diverse Applications

Figure 1

Shiwan Kiln's Top-handle Pots

Note. **A1. Top-handle Pot.** This design is primarily used for boiling water, convenient for outdoor use. Own photograph. The pot's top handle and size make it consistent with the largest pots in the Shiwan kiln range. **A2. Side-handle Pot.** This large design is principally employed for boiling water and features a side handle for a stable and secure grip. Own photograph. **A3. Small Side-handle Pot.** A petite design predominantly used for boiling traditional Chinese medicine, with a side handle and compact size suitable for preparation and pouring of medicinal herb. Source: Photographed and illustrated by the researchers, 2023.

Through a comprehensive evaluation of the existing literature on Shiwan kiln, it was discovered that many studies focus on the historical evolution of Shiwan kiln, its pottery-making techniques, and its position in the history of Chinese ceramics. However, there is a relative need for in-depth research on Shiwan kiln's earthenware pot, especially regarding its craft features, usage history, and social and cultural impacts. Upon comparing and summarizing the research directions, methods, and results of the existing literature, it was determined that there are no specific studies on the cooking utensils of the Shiwan kiln, revealing a significant research gap in this field. Given the critical role of these cooking utensils in the production history of Shiwan kiln and their profound cultural connotations, this research gap is a valuable area for further attention and study. Therefore, conducting in-depth research on the cooking utensils of the Shiwan kiln became essential. The motivation for this research stems from awareness to the research gap in the field of Shiwan kiln's cooking utensils and a deep understanding of their unique value. The study aimed to delve into the manufacturing techniques, characteristic forms, and cultural significance of Shiwan kiln's cooking utensils, seeking to fill this research gap and make substantial contributions to this craft's intangible cultural heritage protection and development. In addition, this

study also aimed to provide valuable insights into modern design and manufacturing and to promote the innovation of traditional Chinese ceramic crafts.

Research Objectives

1. To Analyze Shiwan kiln earthenware pots and how design can be used to foster innovation.

2. To Synthesize innovative design directions that reflect a harmonious blend of tradition and modernity.

3. To Apply the new knowledge and create a new set of Shiwan kiln earthenware pots.

Literature Review

Knowledge gaps and existing research

Through a comprehensive evaluation of the existing literature on Shiwan kilns, we found that many studies have focused on the historical evolution of Shiwan kilns, ceramic manufacturing techniques, and their place in the history of Chinese ceramics. However, there needs to be more in-depth research on Shiwan kiln pottery pots, especially regarding their craftsmanship, history of use, and social and cultural influences. After comparing and summarizing the research directions, methods, and results of existing literature, we identified significant research gaps in this field (Wenjin, 2017a; Yanjuan, 2011; Dajun, n.d.; Wenjia, 2020; Xinliang, 2019; Naishen et al ., 1980; Deer et al., 2013; Yunchuan, 2007).

Importance of filling knowledge gaps

Given the pivotal role of Shiwan kiln cookware in its production history and its profound cultural connotations, this research gap becomes a valuable area for further attention and research. Therefore, it is essential to deeply study the manufacturing technology, characteristic shape and cultural significance of Shiwan kiln cookware. The motivation for this research stems from the awareness of the research gap in the field of Shiwan kiln cookware and a deep understanding of its unique value.

Summary of literature review

This paper proposes apparent knowledge gaps in the Shiwan kiln ceramic cookware field through a comprehensive assessment and systematic analysis of relevant literature. Through in-depth research, it aims to fill this research gap and make a substantive contribution to this craft's

intangible cultural heritage conservation and development. In addition, this study also aims to provide valuable insights into modern design and manufacturing and to promote innovation in traditional Chinese ceramic craftsmanship.

Conceptual Framework

Figure 2

Research Framework

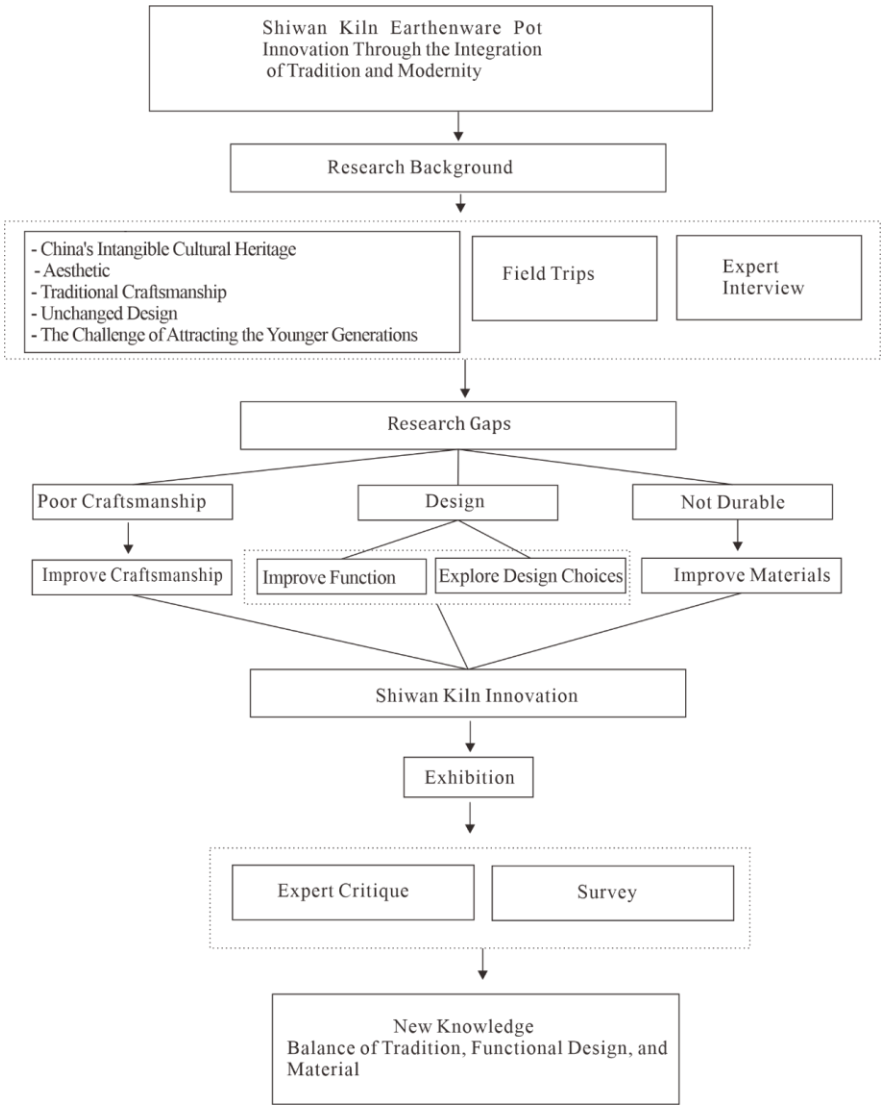


Figure 2 depicts the process to arrive at “The Shiwan Kiln Earthenware Pot: From Tradition to Modernity” innovation. The figure illustrates the research starting from the background of Shiwan kiln ceramics as China's intangible cultural heritage. It presents the identified research gaps, such as crude artistry, monotonous design, and insufficient durability, and the proposed

solutions to improve the process. The innovation section of Shiwan kiln proposes a combination of traditional and modern elements for a new and innovative production and design method.

Research Methodology

This study employed mixed methods—qualitative and quantitative research methods (Khaldi, 2017). First, the qualitative part involves in-depth longitudinal research surveys and interviews. We conducted a three-year intensive follow-up study on Pan Gen, Ou Mei, and Chen Ju, the third and fourth-generation inheritors of the intangible cultural heritage of Shiwan kiln cooking pots (Emerson et al., 2011). In this process, we meticulously recorded their production techniques and usage experience and collected much cultural and historical information about cookware. Through compelling analysis of this information, we discovered the craft and aesthetic uniqueness of Shiwan kiln tanks and potential avenues for improvement and innovation

The quantitative part includes questionnaires conducted among exhibition visitors, seminar participants, and ceramic market consumers (Lewin, 2005). The rationality of this study was validated by quantitative and cross-analysis of the survey data of 300 participants in these three groups. Quantitative research methods enable us to recognize and evaluate the value and potential innovation direction of Shiwan kiln cookware from different perspectives. Provide necessary guidance for our follow-up research and design innovation work

The researchers also organized a special exhibition and seminar on "The Spectacle of Daily Life" Nie Huimei's Shiwan kiln Cookware Intangible Cultural Heritage Research Achievements, and discussed the rationality of the research and the effectiveness of the study of cultural communication through qualitative research expert interviews. We interviewed 13 experts in the seminar, including six ceramic experts, 5 Chinese intangible cultural heritage scholars, and two consumer product marketers. Through in-depth conversations with them, we collected a wealth of suggestions and feedback about Shiwan kiln cookware, which will provide us with follow-up research and design innovations Work provides essential guidance.

Research results

Our study incorporates two dimensions of innovation: design and material. Using these innovative strategies, the researchers successfully developed 68 clay pot products. The redesigned Shiwan kiln cookware now features a more contemporary shape, improved durability,

and increased convenience, thus capturing the attention of young consumers. This study not only addresses the challenges faced by existing pottery products but also caters to the needs of the modern market, leading to a resurgence of Shiwan kiln pottery in today's market and lifestyle.

Figure 3

Design Patents of the Designs by the Researchers

Note. The certificates of “Between Mountains and Rivers”, “One Heart", and "Emotions of the Rainwater” issued by the National Intellectual Property Administration of China after preliminary review by the Patent Law of the People's Republic of China.

Innovation in appearance design

The main problems of Shiwan kiln traditional pots include simple design and rough workmanship. These problems are mainly due to the pursuit of efficiency and lower product prices, the shape of the clay pot has hardly changed since the Ming Dynasty. To solve these problems, we propose the following design innovations.

- Artistic and emotional design

Our approach sought to enhance the appeal of the earthenware pots by introducing artistic and emotive design elements (Coutts, 2001). For instance, through more decadent shapes, we imbued the work with more profound significance and allegorical meaning. In designing the lid knob for the work "Emotion of Rainwater," the designer drew on the stylistic features of fish and water in Chinese culture, expressing the symbolic harmony within Chinese cultural traditions. This

design methodology resonated with Chinese consumers, bolstering their cultural identification and enhancing their understanding and appreciation of the design's implicit meaning (Öcal, 2012).

– The fusion design practice of multicultural symbols

Based on the traditional craftsmanship of traditional Shiwan kiln pottery pots, the researchers introduced architectural elements from Chinese Lingnan culture and landscape modeling elements from Chinese landscape paintings to improve the artistic aesthetics of Shiwan kiln pottery pots (Bürdek, 2005). Introducing multicultural symbols into the design of Shiwan kiln pottery pots is an extension of the traditional design aesthetics of pottery pots. It ensures the artistic uniqueness and relevance of pottery pots as regional cultural symbols and fully combines the symbiosis of local art to form cultural resonance (Bahn et al., 2009)

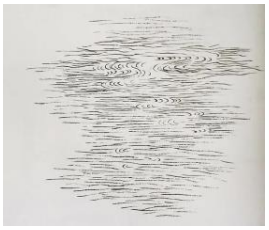
Table 1

Fusion Design Practice of Multicultural Symbols

Process	Description
Transformation of design concepts	Cross-cultural design approach: Incorporating elements of Lingnan architecture and Chinese ink landscape painting into the design. Showcasing individuality and characteristics, transforming tea tasting into a delightful cultural experience, and allowing people to immerse themselves in the charm of Lingnan culture and the ambiance of traditional art.

Lingnan architectural style "huo'er" (ear wall)

Ink portrayal of landscapes



Depiction of water in Chinese painting

Table 1

(continued)

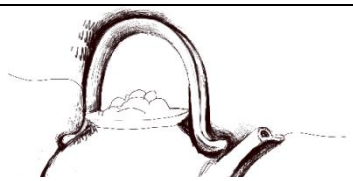
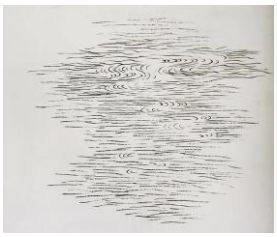
Process	Description
Evolution of sketching	     
Considerations of practicality	1. The capacity of 900 milliliters meets the needs of 3–4 people for brewing tea. 2. The S-shaped design of the spout enables smooth water flow, enhancing convenience during use. 3. The multi-layered lid in a mountain-shaped design allows for easy removal while preventing burns and providing insulation. 4. The outward-extending design of the handle prevents the diffusion of steam, reducing the risk of scalding and ensuring a safer user experience.

Table 1

(continued)

Process	Description
Considerations of Aesthetic Value	 1. The black graphite decoration imparts an elegant charm to the kettle body, presenting a refined and graceful appearance. 2. The design of the kettle handle, inspired by the traditional architectural bracket sets of Lingnan style, showcases a graceful and flowing form, adding a unique artistic touch. 3. The kettle body exudes a sense of stability and grandeur, achieved through careful proportion and form manipulation, resulting in a dignified and composed appearance. 4. The S-shaped spout and the upward curve in design create a smooth and upright form, emphasizing a sense of dynamism and aesthetic appeal. 5. The engraved water pattern decoration conveys Chinese culture and Zen aesthetics, enhancing the artistic quality of the kettle body. 6. The mountain-shaped kettle lid design harmonizes with the overall aesthetics, creating a sense of flow and variation. The overall aesthetic design approach emphasizes the portrayal of form and the use of symbolism, imbuing the product with cultural significance and emotional resonance. It pays homage to Lingnan culture and traditional Chinese landscapes, creating a delightful experience of harmony with nature.
Considerations of User Experience	Customer feedback indicates that the product design embodies the integration of tea and Zen culture, making it more aligned with the aesthetic of Chinese culture and highlighting its unique high-end attributes.

The artistic aesthetics of the pots, secure their artistic individuality as regional cultural symbols, and completely integrate local art, resulting in cultural resonance.

– Mixed Material Design

This study employed the method of mixing materials in the design of pottery pots, combining the natural properties of natural materials, thereby enhancing the pottery pots' aesthetics and functionality. Particularly, the researchers selected wood and vines as the design materials for the pot handles, which has several benefits (Phillipov, 2016). First, in terms of visual

aesthetics, natural materials and clay vessels can be combined to create a sense of aesthetic continuity. The combination of wood and earth materials is consistent with the traditional Chinese five-element culture (Yunchuan, 2007). Lastly, from a functional standpoint, wood materials have lower thermal conductivity, are more pleasant to the touch, and are not readily damaged during daily use and transport. Therefore, this mixed-material design enriches the aesthetics of Shiwan kiln pottery and improves its functionality and practicability (Figure 4).

Figure 4

Pot Handles Made of Wood and Woven Vine

Note. These images depict the innovative use of mixed materials in pottery pot design, with handles made of wood (4A) and woven vines (4B).

The designs are both aesthetically pleasing and practical, taking into account user tactile experience and product durability, while also conforming to the principles of traditional Chinese Five Elements culture. *Source: Photographed by the researchers, 2021.*

– The practice of "slow life" design concept

Japanese daily necessities brand MUJI, French ceramics brand Jars Ceramics, and British handmade soap brand Lush advocate a simple and natural lifestyle to meet consumers' pursuit of environmental protection, health, and high-quality life. The design of Shiwan kiln ceramic pots also pays attention to integrating "slow life" elements to enhance the connotation and brand value of the product (CAFFYN, 2018). This study highlights the tea-tasting situation where people interact with each other and conveys the value and attributes of the brand's unique culture by examining

the current popular form of brewing tea around the stove. The practice of these design innovation strategies, combining traditional and modern elements, aims to enhance the market appeal of Shiwan kiln pots while retaining their traditional artistic charm.

Summary of appearance design innovation ： The innovation of exterior design has fully excavated the essence of Chinese traditional culture and introduced the modern concept of multicultural symbols and mixed material design. Combining art, emotion and regional culture has successfully elevated the appearance of Shiwan kiln pots to a new aesthetic level while maintaining the core of its traditional charm.

Material Innovation

Traditional clay pots are mainly made of quartz sand to enhance strength and heat resistance and improve thermal conductivity and corrosion resistance. However, due to the low firing temperature and failure to sinter the quartz sand, the microscopic pores of the quartz sand make the clay pots prone to water seepage and aging, so their durability is low and easy to break (Hein et al., 2009).

– Material Experimentation

In order to solve the problem that the existing clay pots are easy to break, we have developed the following material innovation scheme: Research on the material research of replacing quartz sand with spodumene in the pottery pot material (Rodrigues & da Costa, 2016) (Table 2). In order to improve the strength and density of clay pots, this study carried out a comparison of related materials. By comparing the strength, sintering degree, and water permeability of spodumene and quartz sand at different firing temperatures, it was found that spodumene has significant advantages. The performance superiority of spodumene pots over quartz sand pots was confirmed. Specifically, the experimental results showed that spodumene pots had a 30% increase in compressive strength and a 20% increase in density compared to quartz sand pots while also being 15% more corrosion-resistant. Spodumene is used instead of quartz sand in the pottery pot material. Compared with quartz sand, spodumene has more evident advantages in terms of thermal stability. Quartz sand has a higher melting point than spodumene and a higher thermal expansion coefficient than spodumene. Such a change makes the clay pot with spodumene less stressed during the heating process and reduces the possibility of cracking. In addition, the sintering temperature of spodumene is low, and the sintering can be completed within the sintering temperature of the mud, which significantly improves the strength, density,

and corrosion resistance of the pot, thereby prolonging the service life of the pot this research has been tested by CNAS and ILAC–MRA authoritative organizations as shown in Figure 5.

Table 2

Comparative Analysis of the Effects of Using Quartz Sand and Spodumene in Pottery Making

Characteristic	Quartz Sand	Spodumene
Thermal expansion coefficient	high (poor)	low (better)
density	lower (poor)	higher (good)
Sintering temperature	higher (poor)	lower (good)
Sintering effect	lower (poor)	strong (good)
Intensity	low (poor)	high (good)
Heat Resistance	low (Poor)	high (Good)
Corrosion resistance	weak (poor)	strong (good)
Service life	shorter (poor)	longer (good)
Water permeability	high (bad)	low (good)
Lead Chromium Precipitation	standards compliant	standards compliant

Note. The researchers evaluated properties including melting point, thermal expansion coefficient, and sintering effect, highlighting spodumene's superior performance over quartz sand in most aspects. Both materials meet criteria for lead–chromium precipitation, suggesting their safety for use. The data suggests that using spodumene may yield better product performance in clay pot production.

Figure 5

Test Report Based on GB/T 3298–2008 and GB/T 3299–2011 Ceramic Testing Criteria from CNAS and ILAC–MRA Authoritative Organizations.

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检测报告

样品名称	煮茶壶	样品编号	H2021012702
送样单位	聂慧梅陶艺工作室		
样品特征	正常	样品数量	200g
实验环境温度	25℃	实验环境湿度	68%RH
检测项目	铅镉迁移	收样日期	2021年01月27日
检测类别	委托检测	完成日期	2021年02月01日
检测依据	GB/T 31604.24-2016 GB/T 31604.34-2016		

检测结果：

序号	项目	标准要求	结果
1	铅迁移量（mg/L）	罐 0.5mg/L	<0.001
2	镉迁移量（mg/L）	罐 0.25mg/L	<0.001

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检测报告

样品名称	煮茶壶	样品编号	Q2021012702
送样单位	聂慧梅陶艺工作室		
样品特征	素坯	样品数量	1个
实验环境温度	25℃	实验环境湿度	68%H
检测项目	见下表	收样日期	2021年01月27日
检测类别	委托检测	完成日期	2021年02月01日
检测依据	GB/T 3298-2008 GB/T 3299-2011		

检测结果：

序号	检测项目	标准要求	结果
1	抗热震性（180℃—20℃水冷热交换一次）	非炙（容量中型 250-1000mL）一次不裂	一次不裂
2	吸水率（%）	细瓷类 ≤0.5%	0.30

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Note. Figure 5A. The report indicates performance for heat shock resistance (with no cracks at 180℃ to 20℃ water–cooling heat exchange) and water absorption rate (0.30% for fine porcelain category, meeting the ≤0.5% requirement). Figure 5B. Lead and Cadmium migration test results based on GB/T 31604.24–2016 and GB/T 31604.34–2016. Own illustration. Note. The results display below threshold values for lead and cadmium migration (Lead migration <0.001 mg/L, below the 0.5mg/L limit; Cadmium migration <0.001 mg/L, below the 0.25mg/L limit).

Summary of material innovation: The material innovation of this study successfully improved the compressive strength, density and corrosion resistance of clay pots by using lepidolite instead of quartz sand. This improvement enhances the functionality and usefulness of the product.

- Modern Lifestyle

The demand for convenience in modern life is the starting point for our design: Given the technical advantages of modern industrial products that employ electronic components to control temperature and heating speed, it is worth studying these to enhance the traditional heating methods of earthenware pots potentially. This type of convenience aligns with the needs of a modern lifestyle (Öcal, 2012). Therefore, to ensure that earthenware pots can meet the demands of the modern market, it is necessary to innovate their convenience features.

- Technology application innovation

Our innovation strategy mainly focuses on the intelligent heating design, by using electronic components to control the temperature and heating speed, which greatly improves the convenience of its use.

Modern Lifestyle Summary : The needs of modern lifestyles are taken as the starting point of the design, emphasizing the close integration of traditional clay pots with modern technology and convenient life. Through the intelligent heating design, the precise control of temperature and heating speed is realized, making the clay pot more suitable for modern life's needs, highlighting the product's convenience and practicality.

- Market Feedback

To validate our innovation strategy, we conduct in-depth research and analysis of the market. We conducted a questionnaire survey, and the researchers analyzed the questionnaire survey results of 300 exhibition visitors, seminar participants, and ceramic market consumers. The results showed that 90% of the respondents highly agree with our innovative concept-combining the traditional craftsmanship features of clay pots with modern and practical designs. Our products have received enthusiastic responses in the market, and the satisfaction rate of consumers for our clay pot products is as high as 85%. At the same time, we also accepted interviews with many experts who spoke highly of our innovation strategy.

The research reveals how innovative design and material studies allow Shiwan kiln pottery to demonstrate its distinctive artistic allure and practical value in contemporary society. It underscores that even though pottery is an ancient craft, it can be integrated into modern life through technological advances and innovative ideation, assuming new forms and values and garnering market recognition. This is a crucial insight for protecting and developing the Shiwan kiln and other traditional crafts. Furthermore, this study contributes a novel perspective and direction for ceramic material research, particularly for spodumene application. Ultimately, our findings facilitate the fusion of traditional Chinese craftsmanship with modern design and technology, offering a meaningful reference for future design and production.

Discussion

Innovation and Tradition

This study engaged in a nuanced analysis of the production process and design features of the Shiwan kiln earthenware pot, focusing on integrating traditional craftsmanship with modern

design concepts. Despite potential conflicts between traditional craftsmanship and modern design, an organic synergy was found, reflecting the successful alignment of Shiwan kiln pots with modern life's requirements (Yuzi, 2014).

Challenges and Limitations

While the current design trend of boiling pots poses challenges, Shiwan Kiln is a powerful example of maintaining tradition while innovating. However, the limitations of this study include a short research duration and a primary focus on boiling water and tea functions, suggesting room for extended research on Shiwan kiln pots' culinary functions.

The innovative approach yielded 68 new clay pot products that cater to the modern market, signalling the possibility of rejuvenating traditional crafts with modern design concepts. This lays a new path for protecting and developing traditional crafts and fostering cultural heritage.

Knowledge from Research

The synthesis of the research findings is illustrated through the following concepts:

1) Integration of Tradition and Modernity: A harmonious blend revitalizes traditional craft.

2) Material Innovation: Enhancing durability through material substitutions.

3) Design Innovation: Creating appeal to younger audiences through modern design concepts.

These findings are visualized through diagrams, charts, or concept maps, offering a concise and accessible overview of the research's contributions to the field.

Conclusion

Research Contributions

1) This study's primary goal was to explore the potential of design innovation in the Shiwan kiln earthenware pot. Significant findings include enhancements in the robustness and lifespan of ceramics through material innovation and the development of 68 novel ceramic products that blend traditional craftsmanship with modern elements (Norman, 2004; Deer et al., 2013).

2) Implications for Design Innovation

Our innovative design direction, involving artistic and dynamic elements, multicultural symbol fusion, and mixed material design, has revived Shiwan Kiln earthenware pot for the

younger generation. This innovation aligns with previous studies on design innovation (Johnson & Onwuegbuzie, 2004) and offers practical insights into merging intangible cultural heritage with contemporary life.

The research successfully demonstrated the delicate balance between conservation and innovation in Shiwan kiln ceramics, fulfilling its objectives and substantially contributing to traditional craft and modern design. It impacts the field of design research and the protection of cultural heritage (Stark, 2003).

Suggestions

For future work, extending the research timeline and delving into other culinary functions of Shiwan kiln earthenware pots is recommended. This would yield a more comprehensive understanding of the traditional craft and present more opportunities for innovative product development. Moreover, a continuous collaboration between artisans, designers, and researchers can foster a sustainable and innovative platform for preserving and enhancing the rich traditions of Shiwan kiln pottery.

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