



Study on the Application of Modern Digital Technology in Art and Design Education: An Example of Integrating AI Drawing with 3D Printing in Ceramic Jewelry Design Instruction

Yuanqian Lai^{1a}, Xiaobing Hu^{2*}

¹School of Art, Southeast University, Nanjing 210018, China

²Fine Art School, Anqing Normal University, Anqing 246001, China

^a101300148@seu.edu.cn; *Corresponding author's e-mail: 1976hxb@163.com

Abstract. The mutual construction of technology and art is a long-standing tradition, and the integration of digital technology into art and design education is a prevailing trend today. This paper begins by reflecting on the general and specific issues present in current ceramic jewelry design courses and proposes a strategy for incorporating AI drawing and 3D printing technologies into ceramic jewelry design instruction. It elucidates the new pathways and comprehensive advantages that emerge from combining AI drawing and 3D printing in educational practice. Finally, it delves into the empowerment and impact of digital technology on art and design instruction, aiming to better cultivate ceramic jewelry design talents that meet contemporary needs.

Keywords: Digital Technology; Ceramic Jewelry Design; AI drawing; 3D printing

1 Introduction

Art and design is a multidisciplinary and diverse field that encompasses a wide range of content and forms, characterized by its flexibility and diversity. Digital teaching in art and design, which adheres to modern educational theories and practices while employing advanced digital tools and instructional models, aims to cultivate innovative talents suited for the demands of the modern era [1]. In the context of today's digital age, education based on digital technology signifies the educational model of the 'knowledge economy society.' Digital art and design education not only challenges traditional educational paradigms but also significantly influences contemporary design practices. Ceramic jewelry design, a niche within art and design, is based on ceramic art and craft practices and oriented towards market-driven design and production training. It covers various aspects such as design theory, methodology, representation techniques, craftsmanship, and market trends. The focus is on guiding students towards personalized design and developing their comprehensive abilities in creative thinking,

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design methods, and the application of ceramic materials and techniques. The objective is to enhance students' understanding and application of ceramic jewelry design, deepening their awareness of the relationship between design, materials, and craftsmanship, thereby establishing a solid foundation in design concepts and directions for future endeavors in ceramic art and design. Integrating digital technology into this curriculum not only provides new creative tools and instructional methods for art and design but also improves the quality of instruction and learning outcomes.

Research indicates that the integration of digital technology into modern art and design education is widely regarded as a future trend [2]. However, in the field of ceramic jewelry design education, the focus has predominantly been on innovative thinking in product design, specific practices in secondary and vocational institutions [3] [4], and the educational philosophy of 'teaching-led research and research-enhanced teaching,' with less emphasis on the integration of digital technology into ceramic art and design education [5] [6]. Therefore, this paper attempts to reflect on practical issues encountered in teaching against the backdrop of the digital era and proposes a strategy for integrating AI drawing and 3D printing into ceramic jewelry design instruction. By developing new instructional pathways and elucidating the combined advantages of these technologies, the paper further explores their potential to empower and impact ceramic jewelry design.

2 Issues Identified in Long-Term Ceramic Jewelry Design Teaching and the Technological Conditions of the Digital Age

In the long-term practice of teaching ceramic jewelry design, I have identified and reflected on a series of both general and specific issues. Regarding the general issues common to art and design education, those in ceramic jewelry design teaching mainly manifest in five aspects: The relative obsolescence of teaching tools and content. With rapid technological advancements, the tools and techniques for ceramic jewelry design are constantly evolving. However, the pace of updating teaching content often lags behind, leading to a gap between the skills students acquire and the actual needs of the industry. The lack of independent and innovative thinking. There is an over-reliance on traditional design concepts and techniques while the cultivation of students' innovative thinking is somewhat neglected. In today's era, fostering students' innovative thinking is particularly important, necessitating an adjustment in teaching strategies to emphasize the development of students' creative thinking and independent problem-solving abilities. The insufficient integration of theory and practice. Students may grasp theoretical knowledge but often find it challenging to apply this knowledge to solve practical problems. Therefore, there is a need to strengthen practical teaching components to enhance students' practical skills and problem-solving capabilities. The neglect of cultural connotations. As an art form with profound cultural significance, the cultural aspects of ceramic jewelry are often overlooked in teaching. It is crucial to pay more attention to cultivating students' cultural literacy, guiding them to delve into the cultural essence of ceramic jewelry and understand its historical and artistic value. Flaws in the

teaching evaluation system. There is a need to further refine the evaluation system to comprehensively assess students' work, thereby stimulating their creativity and enthusiasm. A reasonable assessment mechanism can better encourage students to express their creativity and potential. As for the specific issues unique to ceramic jewelry design education, they include: The high practicality of ceramic jewelry design teaching requires the mastery of various skills. Students need to learn not only the relevant theoretical knowledge of ceramic jewelry design but also the practical skills of artistic expression and presentation, as well as specific experiential knowledge related to ceramic production. Especially in the process of transforming two-dimensional designs into three-dimensional objects, strong modeling skills are essential. The intricate teaching process of ceramic jewelry design requires a lengthy time period. According to the allocation of teaching hours, a typical ceramic jewelry design course totals 48 hours, divided into 4 hours of theoretical instruction, 4 hours of market research and literature review, 12 hours of jewelry design, 12 hours of jewelry shaping, 12 hours of jewelry decoration, and 4 hours of glazing and firing accessories. In reality, the design, production, decoration, and firing processes of ceramic jewelry take more time than those in other art and design disciplines, with the firing process alone requiring significant time, effort, and cost. Frequent minor issues in the design and production phases of ceramic jewelry design teaching. Due to the small size and limited expressive space of ceramic jewelry, the design requirements are relatively higher, leading to a higher rate of damage during production and firing. To better cultivate outstanding ceramic jewelry designers, it is essential for researchers to acknowledge these issues and continuously improve and refine teaching methods and content.

Simultaneously, we are in an unprecedented digital age, where advanced digital technologies for information collection, processing, and dissemination are propelling the development of contemporary design and changing the existence and development direction of human culture in unprecedented ways and speeds [6]. In the field of ceramic jewelry design education, digital technologies have also had a positive impact. For example, the rapid development of digital technologies like 3D printing provides strong support for meeting individualized demands. This digital production method not only improves efficiency but also makes customized and personalized designs feasible, further enriching the diversity and uniqueness of products. The advent of digital simulation technology allows for more accurate predictions of potential issues during production and firing, enabling adjustments to be made in advance to optimize design schemes and reduce unnecessary losses, making the entire production process more stable and reliable. The digital age offers us a wealth of tools and platforms, but it also requires students to possess interdisciplinary knowledge and skills that combine design concepts with technology. To better meet this challenge, educators, students, and practitioners must work together to continuously explore new teaching methods and strategies to adapt to the ever-changing digital era.

3 New Pathways and Advantages of Integrating AI Drawing and 3D Printing Technology in Modern Ceramic Jewelry Design Instruction

In adapting to the development needs of the digital era within ceramic jewelry design teaching, a new teaching pathway integrating AI drawing and 3D printing has been developed based on in-depth research and practice. This pathway, in addition to the preliminary theoretical lectures, research, and literature review, mainly consists of six parts: Idea Conceptualization and Sketching: Initially, teachers guide students to delve deep into design concepts, significantly stimulating their creative thinking. In this phase, students use AI drawing tools to transform their creative ideas into detailed sketches, laying a solid foundation for subsequent 3D modeling. 3D Model Construction: With AI assistance, students efficiently convert sketches into 3D models, adhering to strict operational standards to ensure model accuracy. This stage deepens students' understanding of 3D printing technology and prepares them for the actual production process. Model Rendering and Optimization Assessment: Leveraging AI's powerful rendering capabilities, students can add realistic visual effects to their jewelry, making it more vivid and three-dimensional. Comprehensive model optimization assessments are conducted to ensure their suitability for 3D printing, considering various factors to ensure model feasibility. 3D Printing Execution: After optimizing the model, students send it to a 3D printer for physical printing. They must follow strict printing standards, mastering printer operation techniques and material selection principles to ensure the desired print quality. Post-Processing and Presentation: After printing, students perform post-processing tasks like cleaning, polishing, and coloring to refine the final product. Students then present their work for professional evaluation, enhancing their presentation skills. Feedback and Redesign: Based on feedback, students reflect on their design process to identify improvement areas, then redesign, model, print, and reassess. This feedback loop continuously enhances students' design and practical skills.

The application advantages of AI drawing technology include driving design innovation, increasing efficiency and precision, and making data-based design decisions. It excels in representing two-dimensional visual effects [7]. 3D printing technology's advantages lie in realizing complex designs, rapid prototyping and customization, and optimizing production processes, excelling in three-dimensional design expression. In ceramic jewelry design education, the combination of these cutting-edge technologies not only provides strong technical support for optimizing the teaching process but also demonstrates the synergistic advantages of their integration. AI drawing technology can quickly generate diverse design solutions, significantly enhancing design innovation and efficiency. The introduction of 3D printing technology allows these designs to be materialized, achieving customization goals and further improving production efficiency and precision. AI drawing technology's ability to understand natural language and generate responses clarifies design thoughts and tightens logic. 3D printing technology can produce high-precision, high-quality ceramic jewelry, enriching design expression possibilities. Furthermore, the application of AI drawing and 3D printing technologies significantly shortens production cycles, reducing the time from concept to

final product, thus improving teaching efficiency. These technologies also help reduce production costs, making ceramic jewelry design more accessible to students. Lastly, they expand the range of design materials by allowing printing with various powder materials, providing students with more design materials and inspiration. AI drawing and 3D printing technologies play a crucial role in enhancing design innovation, efficiency, enriching design expressions, shortening production cycles, reducing costs, and expanding material choices in ceramic jewelry design education. As technology advances, the application prospects of these technologies in ceramic jewelry design instruction are set to widen even further.

4 Empowerment of Digital Technology in Modern Ceramic Jewelry Design Teaching and Its Industry Impact

With the continuous evolution of technology, digital technology has become a significant driving force in modern ceramic jewelry design education. Its application has not only enhanced design efficiency and precision but also brought revolutionary changes to teaching methods and content, achieving the fundamental goal of empowerment. The manifestations of this empowerment include:

Unprecedented Precision and Efficiency: Traditional jewelry design relied heavily on manual craftsmanship and accumulated experience. The advent of digital technology has simplified this process. Computer-aided design software allows designers to execute precise designs and modeling on computers, significantly enhancing efficiency and accuracy. Moreover, digital technology facilitates easier modifications and optimizations during the design process, offering designers greater creative freedom.

Rich Resources and Teaching Methods: Digital technology enables teachers to demonstrate the entire design process to students, aiding in a better understanding and mastery of key design aspects. Additionally, virtual reality functions of digital technology allow students to engage in practical operations within a virtual environment, deepening their understanding of design and improving learning outcomes.

Simplified Manufacturing Process for Ceramic Jewelry: Traditional ceramic manufacturing involves multiple processes and firing stages, whereas digital technology enables designers to produce finished products directly from digital models. This transformation not only reduces production costs but also enhances product quality and consistency. In the educational context, students gain a deeper understanding of the manufacturing process, enhancing their practical and hands-on skills.

Broader Creative Expression for Designers: Traditional ceramic jewelry design was limited by materials and craftsmanship. Digital technology breaks these boundaries, enabling designers to freely explore various creative ideas. For instance, 3D printing technology can create complex shapes and structures that are difficult to achieve with traditional methods, providing designers with a broader creative canvas. In teaching, instructors can guide students to explore various possibilities, fostering their innovative thinking and practical skills.

Enhanced Analytical and Assessment Tools for Teachers: Digital technology offers teachers more means to analyze and evaluate student work, making teaching feedback timelier and more accurate.

AI drawing and 3D printing technologies have become indispensable tools in ceramic jewelry design education. These technologies not only improve design efficiency and precision but also strongly support the cultivation of students' innovative thinking. AI drawing enhances design innovation and optimizes design decisions, significantly improving the quality and efficiency of student designs. This not only reduces the time and effort of traditional manual drawing but also provides a wider range of design options, further stimulating students' creative thinking. AI drawing technology also offers designs closer to market trends and consumer demands, training students to adapt to market changes. On the other hand, 3D printing technology reduces the complexity of production and enables rapid prototyping and customization [8]. This technology allows complex designs to be realized, breaking the limitations of traditional production methods. Students can quickly obtain finished products, greatly improving production efficiency. This application helps students prototype during the design process, identifying and correcting issues to refine their designs.

Meanwhile, digital technology indirectly impacts the modern ceramic jewelry design field, touching on aspects like the integration of technology and innovation, the evolution of the designer's role, user experience and market adaptability, and considerations of ethics and aesthetics.

5 Conclusions

Technology and art, while independent entities, share an intricate and constructive relationship. The application of digital technology in the teaching of modern ceramic jewelry design represents not just a technological revolution but also a profound exploration of teaching philosophies, processes, and modes of expression. The integration of AI drawing and 3D printing, in particular, plays a pivotal role in this context, enhancing design efficiency and precision, streamlining the manufacturing process, enriching teaching resources and methods, and stimulating students' innovative thinking and practical skills. This technological advancement poses new challenges and opportunities to traditional teaching methods, heralding transformative changes in the field of ceramic art design and offering insights into the complex interplay between technology, art, and creativity. As digital technology continues to evolve and improve, its significance and impact in design education will become increasingly vital. Teachers should leverage the advantages of digital technology to enhance teaching quality and outcomes, cultivating a new generation of ceramic jewelry designers who possess both innovative capabilities and a practical spirit.

In the process of modernizing art and design education, it is essential to maximize the benefits of digital technology to foster innovation and development in educational practices. However, it is also crucial to use digital technology judiciously, acknowledging its role without becoming overly reliant on it, as this reliance might overshadow the value of manual craftsmanship. Therefore, educators should employ these technologies judiciously, balancing the enhancement of students' technical skills with the cultivation of their manual abilities and artistic sensibilities, to nurture talents with innovative thinking and practical skills in the ceramic jewelry design field.

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