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Under the Wave of Digitalization: Construction and Teaching Innovation of the Online Course "Product Form Design Technology"

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Abstract: Against the backdrop of the full penetration of digital technologies and the vigorous development of online education, the course Product Form Design Technology is facing reform pressures to adapt to industrial demands and cultivate interdisciplinary design talents. Based on the reshaping effect of the digital wave on product design teaching, this paper focuses on the core proposition of curriculum construction and proposes a modular curriculum system construction path featuring the "technology-creativity-practice" trinity. By creating immersive and interactive teaching scenarios and building a linked practice platform integrating "online-offline-industry", it realizes the transformation of the teaching model from "knowledge transmission" to "competency development". Meanwhile, it clarifies the guarantee measures for teaching innovation from three dimensions: technical support, teacher capacity transformation, and a diversified evaluation system. Ultimately, it aims to cultivate interdisciplinary talents with digital design capabilities, creative abilities, and collaborative skills, providing practical references for the comprehensive reconstruction and high-quality development of the course.

Keywords: Digitalization; Product Form Design Technology; Online Courses; Teaching Innovation; Curriculum Construction; Interdisciplinary Talents.

1. Introduction

Today, as digital technologies permeate all walks of life, the field of product design is undergoing profound transformations. Both traditional design processes and teaching models are in need of reconstruction. In the past, product form design relied on hand-drawn sketches and physical models for creative expression and scheme verification. This approach not only suffered from low design efficiency and difficulty in revising schemes but also disconnected from actual industrial application scenarios, leaving students struggling to quickly adapt to job requirements after graduation. Nowadays, however, digital tools have become the norm in the design industry. Technologies such as parametric modeling, virtual reality (VR) preview, and 3D printing verification are widely applied, requiring designers to possess full-process capabilities—from digital modeling to visual presentation, and from collaborative design to iterative optimization. Traditional teaching content and methods can no longer meet the demands of industrial development. [1]

At the same time, industrial demand for design talents has shifted from single form-shaping ability to comprehensive "technology + creativity + collaboration" capabilities. Enterprises prefer design talents who are proficient in digital tools such as Cinema 4D, 3Dmax, and KeyShot, and who possess both user thinking and data insight. This demand has forced the course Product Form Design Technology to break the temporal and spatial limitations of traditional classrooms, promoting the shift of teaching focus from "knowledge transmission" to "competency development".

In addition, the vigorous development of online education has provided an important opportunity for curriculum reform. Online education breaks the temporal and spatial constraints of traditional classrooms. Through live interaction, recorded review, collaborative platforms, and other forms, it can achieve more flexible teaching organization and deeper teacher-student interaction. It can also analyze students' learning behaviors with big data technology to support personalized teaching, effectively addressing issues such as the "one-size-fits-all" approach and low student participation in traditional teaching. As a core course connecting design theory and practical application, the innovation of the teaching model of Product Form Design Technology is directly related to the cultivation of innovative capabilities and technical literacy of design talents. Against this backdrop, reconstructing the curriculum system, innovating teaching methods, and optimizing teaching experience have become the core propositions of the course construction. Only through comprehensive reforms can we cultivate interdisciplinary design talents adapting to the needs of the digital era, realizing the synchronous development of education and industrial progress.

2. The Reshaping of Product Form Design Teaching by the Digital Wave

Digital technologies have not only transformed the creative tools and processes of product form design but also restructured the core logic and goal orientation of teaching. In traditional teaching, students relied on hand-drawn sketches and physical models for design expression, which had problems such as low efficiency, difficulty in revision, and disconnection from industrial reality. With the popularization of digital tools, parametric modeling, virtual reality (VR) preview, 3D printing verification, and other technologies have become design norms, requiring students to possess full-process capabilities—from digital modeling to visual presentation, and from collaborative design to iterative

optimization. [2]

Meanwhile, the industrial demand for design talents has shifted from a single form-shaping ability to comprehensive "technology + creativity + collaboration" capabilities. Enterprises prefer design talents proficient in digital tools such as Cinema 4D and 3Dmax, who also have user thinking and data insight. This demand has forced the course Product Form Design Technology to break the temporal and spatial limitations of traditional classrooms. Through online, digital, and scenario-based teaching reforms, it realizes the transformation from "knowledge transmission" to "competency development", enabling students to enhance their digital design application capabilities in teaching scenarios close to industrial reality.

3. Core Paths for the Construction of the Online Course "Product Form Design Technology"

The online course construction focuses on three core aspects: building a "Technology-Creativity -Practice" trinity modular system with digital design as the main line, integrating cutting-edge technologies and dynamic resources; creating "immersive-interactive-personalized" scenarios via VR, collaborative platforms and big data; and constructing an "Online-Offline-Industry" linked practical platform to form a closed loop and connect teaching with industry.

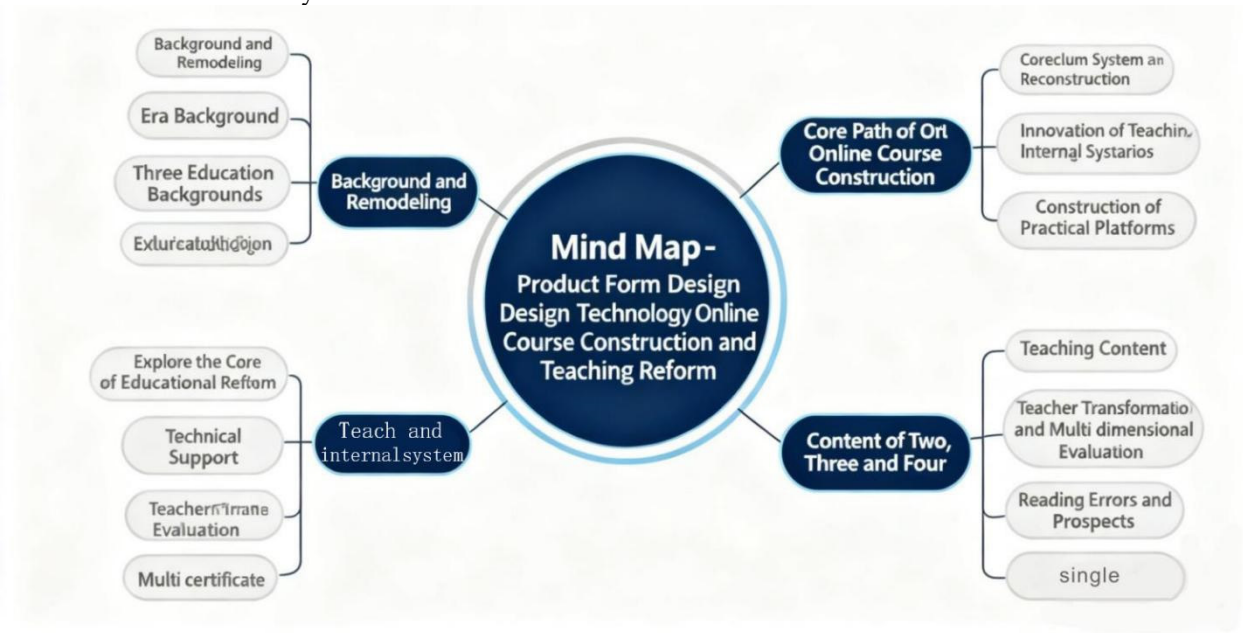

Figure 1. Mind Map -- Construction and Teaching Reform of the Online Course "Product Form Design Technology"

3.1. Constructing a "Technology-Creativity-Practice" Trinity Curriculum System

The core of online course construction lies in breaking the chapter-based structure of traditional courses. Centering on the digital design process, it reconstructs a modular curriculum system featuring "technical foundation - creative divergence - practical implementation".

The technical foundation module focuses on practical teaching of digital tools, covering core content such as Cinema 4D basic modeling, rendering techniques, and parametric design. Through step-by-step demonstrations, case analysis, and online Q&A, it helps students consolidate technical skills.

The creative divergence module integrates user research, data visualization analysis, and design thinking. With tools like online mind mapping and collaborative design platforms, it guides students to develop creative concepts based on user needs.

The practical implementation module takes real projects as carriers, introducing actual enterprise design topics. Students complete the full-process practice from conceptual design to digital model optimization, and from rendering output to project presentation through team collaboration.

Course content selection balances foundation and cutting-edge trends. It ensures students master core tools and design principles while promptly integrating emerging technologies such as industrial internet and AI-assisted design. Extended modules like "AI-Generated Design for Creative Support" and "Application of Digital Twins in Product Design" are offered to broaden students' technical horizons. Meanwhile, a dynamically updated course resource library is established, integrating high-quality design cases, tool tutorials, and industry standards to support students' continuous learning.

3.2. Creating an "Immersive-Interactive-Personalized" Online Teaching Scenario

The advantage of online courses lies in breaking temporal and spatial limitations, but their core challenge is avoiding "one-way indoctrination" and enhancing students' sense of participation and gain. To this end, digital technologies are used to build diversified teaching scenarios: [3]

Through VR virtual laboratories, students immerse themselves in experiencing the 3D spatial relationships of products, intuitively perceiving the design effects of form proportions and material textures.

Using online collaborative platforms, cross-regional team collaboration is organized to simulate real enterprise design workflows, fostering students' communication and collaboration capabilities.

A combined "live broadcast + recorded lecture" teaching model is adopted. Live courses focus on case analysis, practical tool demonstrations, and real-time interactive Q&A, while recorded courses allow students to review repeatedly on demand, catering to different learning paces.

Meanwhile, big data technology is applied to empower personalized teaching. By analyzing students' learning progress, homework completion, and tool operation frequency, their weak points are accurately identified, and customized supplementary learning resources and practice tasks are pushed. For example, students with weak modeling skills receive targeted basic modeling training, while those lacking creative divergence are recommended excellent design cases and creative method courses, realizing "personalized guidance for each student".

3.3. Building an "Online-Offline-Industry" Linked Practical Teaching Platform

Product form design is a highly practical course. Online teaching must break the dilemma of "empty talk" and build a closed-loop practical teaching system.

On one hand, virtual practice scenarios are built on online platforms, with simulated design projects enabling students to complete full-process training from concept to model in a digital environment. Through online mutual evaluation, teacher comments, and remote guidance from enterprise experts, the quality of works is improved.

On the other hand, the practical barrier between online and offline is eliminated. Students are encouraged to use offline equipment such as 3D printers to convert digital models into physical prototypes, then share practice processes and results via online platforms, forming a closed loop of "digital design - physical verification - online feedback".

The core is to establish an in-depth school-enterprise cooperation model, fully integrating real enterprise business projects into the overall framework of online courses. On one side, senior enterprise design experts are invited to deeply participate in curriculum system construction and teaching practice guidance. Through enterprise thematic sharing, real project task release, and joint online work evaluation, students face the actual needs and industry standards of frontline industrial production. On the other side, efforts are made to build display windows and transformation channels for students' design achievements. Students are encouraged to connect polished high-quality design schemes with market resources through online promotion channels or participate in various professional design competitions, thereby opening up a complete link of "teaching - practical application - industrial implementation" and realizing seamless integration among the three.

4. Key Guarantees for Teaching Innovation: Technical Support and Conceptual Upgrade

4.1. Strengthening Digital Teaching Technical Support

The smooth advancement of online courses relies on a stable and efficient technical platform. A comprehensive teaching platform integrating multiple functions—such as teacher-student interaction, resource storage, collaborative design, and data statistics—should be selected to ensure smooth video playback, timely interactive responses, and secure data storage. Meanwhile, a mobile-adapted course application should be developed to support students in learning anytime and anywhere using fragmented time, fully meeting their demand for flexible learning. In addition, AI-assisted teaching tools (e.g., intelligent Q&A robots, intelligent design scheme evaluation systems) can be introduced to effectively reduce teachers' workload and further improve overall teaching efficiency.

4.2. Promoting the Transformation of Teachers' Teaching Concepts and Capabilities

Teachers are the core implementers of teaching innovation and need to shift from traditional "knowledge transmitters" to "learning guides" and "resource integrators". They must not only proficiently master the operation skills of various digital design tools and online teaching platforms but also possess the ability to integrate industrial resources, design practical projects, and guide students' independent learning. By organizing teachers to participate in digital teaching training, enterprise practice workshops, and online teaching exchanges, their digital teaching capabilities and industrial docking capabilities are enhanced, ensuring that teaching content is aligned with industrial reality.

4.3. Establishing a Diversified Teaching Evaluation System

To fully break the limitations of single-item evaluation in traditional exam-oriented education, a trinity multi-evaluation framework combining "process evaluation + outcome evaluation + practical competence evaluation" should be built:

Process evaluation focuses on exploring the potential value of process data (e.g., online learning duration, depth of interactive participation, homework completion quality) to accurately capture learning dynamics.

Outcome evaluation centers on core indicators such as the creativity of design works, implementation of technical specifications, and visual presentation effects to comprehensively measure learning outputs.

Practical competence evaluation integrates multi-dimensional information (e.g., professional reviews from enterprise experts, actual performance in project operations, awards from various competitions) for comprehensive and objective assessment.

The implementation of this multi-evaluation mechanism can three-dimensionally reflect students' knowledge absorption, technical operation capabilities, and innovative practice levels. It further guides students to shift from "result-oriented" to "process-oriented" learning, encouraging them to actively focus on learning accumulation and the steady improvement of comprehensive capabilities. [4]

5. Conclusion

The digital wave has brought unprecedented development opportunities and higher teaching requirements to the course Product Form Design Technology. The construction and teaching innovation of online courses are not a simple "shift of offline courses to online platforms" but a comprehensive reconstruction of the curriculum system, teaching methods, and evaluation models—supported by digital technologies and oriented to industrial needs. By constructing a "technology-creativity-practice" trinity curriculum system, creating immersive interactive teaching scenarios, and building an industry-linked practical platform, the quality of course teaching can be effectively improved, cultivating interdisciplinary product design talents who meet the needs of the digital era.

In future teaching practice, continuous attention should be paid to the development trends of digital technologies and changes in industrial demands. Curriculum content and teaching methods need to be continuously optimized to promote the upgrade of online courses from "usable" to "high-quality" and "efficient". Ultimately, the course Product Form Design Technology will truly become a bridge connecting design education and industrial practice, injecting a steady stream of talent momentum into the innovative development of the product design field.

Acknowledgments

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