

# Digital Twin Empowers the Alignment of Industry and Education in Home Economics

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**Abstract:** The home economics service industry, as a crucial support for people's livelihood and consumption upgrading, urgently requires a supply of specialized high-skilled talent for its high-quality development. Currently, the alignment between home economics majors and industry-education faces practical challenges such as a disconnect between talent training and industry needs, insufficient practical teaching resources, and ineffective collaborative education mechanisms. Digital twin technology, with its core advantages of virtual-physical mapping, real-time interaction, and simulation, provides a new pathway to address the pain points of industry-education integration. Based on the latest policy directions such as the "Opinions on Deepening the Integration of Industry and Education in the Home Economics Service Industry," and incorporating core research achievements like "Post-Course-Competition-Certification-Training-Innovation," this paper constructs a "Policy Guidance - Technology Empowerment - Mechanism Innovation - Practical Implementation" framework for digital twin-empowered alignment of industry and education in home economics majors. It proposes optimization strategies for the talent training model from four dimensions: curriculum system restructuring, teaching model innovation, collaborative mechanism optimization, and evaluation system improvement, providing theoretical reference and practical paradigms for cultivating high-skilled talent in home economics majors.

**Keywords:** Digital Twin, Home Economics Major, Training Model.

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## 1. Introduction

### 1.1. Research Background

The home economics service industry has become an important sector for expanding employment and promoting consumption upgrading. China's home economics service workforce exceeds 30 million, and the market size is expected to surpass 1.3 trillion yuan by 2027. However, the contradiction between high-quality industry development and talent supply is becoming increasingly prominent. There is a severe shortage of high-quality, specialized talent, and a lack of digital and standardized service capabilities has become a key bottleneck constraining the industry's quality improvement and expansion. Industry-education integration, as the core direction of vocational education reform, is the fundamental path to achieving precise alignment between talent training and industry needs. In 2024, the National Development and Reform Commission and four other departments jointly issued the "Opinions on Deepening the Integration of Industry and Education in the Home Economics Service Industry," explicitly proposing 16 practical measures, including building a multi-level talent training system and promoting the digital empowerment of the home economics industry for high-quality development, thus outlining the policy direction for industry-education integration in home economics majors.

Digital twin technology, as one of the core technologies of Industry 4.0, has demonstrated strong application potential in the field of vocational education. By constructing precise mappings between the physical world and virtual space, it enables the visualization, traceability, and optimization of the teaching process, providing technical support for deep industry-education integration. Current research has focused on innovations in home economics talent training models such as "Post-Course-Competition-Certification-Training-

Innovation," but in-depth research on the integration of digital twin technology with the alignment of industry and education in home economics majors is still in its infancy. How to use digital twins to solve problems like the disconnection between education and industry and weak practical teaching in home economics majors has become an important topic requiring urgent exploration.

### 1.2. Research Significance

#### 1.2.1. Theoretical Significance

Enriches the application research of digital twin technology in modern service industry vocational education, constructs a theoretical framework for technology-empowered industry-education alignment, expands the research perspective on talent training models for home economics majors, and provides new theoretical support for the digital transformation of industry-education integration in vocational education.

#### 1.2.2. Practical Significance

Addresses the practical pain points in the alignment of industry and education for home economics majors, proposes actionable optimization paths for a digital twin-empowered training model, helps institutions improve the quality of talent training, alleviates the shortage of high-skilled talent in the industry, and promotes the digital and specialized development of the home economics service industry.

### 1.3. Current Research Status Domestically and Internationally

Home economics education started earlier abroad. Countries like the United States and Japan have established mature home economics vocational education systems, emphasizing the precise alignment between practical teaching and industry needs. Some institutions have introduced virtual simulation technology for contextualized teaching, laying the foundation for the application of digital twin technology.

Domestically, scholars have explored industry-education integration in home economics majors from multiple dimensions. The training model "Post-Course-Competition-Certification-Training-Innovation" constructed by Qingyuan Polytechnic, through the multi-faceted synergy of post-oriented teaching, practical training transformation, and innovation incentives, has effectively enhanced students' comprehensive abilities. In digital twin application research, existing achievements are concentrated in fields like smart manufacturing and construction. Application research in the vocational education field mostly focuses on engineering majors, while related research for modern service industry majors like home economics is relatively scarce, and a mature technology-empowered industry-education alignment solution has not yet been formed.

## **2. Real-World Challenges in Aligning Home Economics Majors with Industry-Education and the Empowerment Logic of Digital Twins**

### **2.1. Real-World Challenges in Aligning Home Economics Majors with Industry-Education**

#### **2.1.1. Disconnect between Talent Training and Industry Needs**

Home economics services have expanded towards specialized directions such as elderly care, maternal and infant care, and smart home operation and maintenance. However, the curriculum system in institutions lags in updates, teaching content deviates from actual job requirements in the industry, and there is a lack of digital service skills training modules.

#### **2.1.2. Insufficient Supply of Practical Teaching Resources**

Home economics service scenarios are characterized by privacy and dispersion, making it difficult for institutions to build comprehensive training bases. The capacity of enterprises to accept interns is limited, students lack opportunities for practical operation training, and it is challenging to accumulate hands-on experience.

#### **2.1.3. Ineffective Operation of Collaborative Education Mechanisms**

The home economics industry is predominantly composed of small and medium-sized enterprises, with few large-scale leading companies. School-enterprise cooperation often remains superficial, lacking long-term, stable benefit linkage mechanisms. Industry standards and enterprise technologies are difficult to effectively integrate into the teaching process.

#### **2.1.4. Lack of Scientific Evaluation System**

Existing evaluations often focus on theoretical knowledge assessment. The evaluation standards for practical abilities and professional literacy are vague, making it difficult to comprehensively reflect students' job adaptability and effectively feedback the effectiveness of industry-education integration.

## **2.2. Core Logic of Digital Twin Empowering the Alignment of Industry and Education in Home Economics Majors**

### **2.2.1. Virtual-Physical Mapping Enables Precise Demand Alignment**

Digital twins can construct virtual models of the entire home economics industry chain, collect real-time enterprise job demand data, transform industry standards and operational norms into teaching content, and achieve dynamic matching between talent training specifications and industry needs.

### **2.2.2. Simulation Breaks Through Practical Teaching Bottlenecks**

By setting up virtual training scenarios that replicate real service environments like elderly care, home cleaning, and maternal and infant care, students can conduct repeated practical training, avoiding safety risks and ethical issues in real-world scenarios.

### **2.2.3. Real-Time Interaction Optimizes the Collaborative Education Process**

Digital twin platforms can break down information barriers among multiple entities such as institutions, enterprises, and industry associations, enabling real-time sharing of teaching processes, training effects, and job feedback, thus promoting the normalization of school-enterprise collaborative education.

### **2.2.4. Data-Driven Improvement of the Quality Evaluation System**

Based on the teaching and training data accumulated on the digital twin platform, a multi-dimensional evaluation indicator system can be constructed to achieve precise assessment and dynamic optimization of student abilities, teaching effectiveness, and industry-education alignment.

## **3. Construction of a Digital Twin-Empowered Training Model for Aligning Home Economics Majors with Industry-Education**

Following the construction logic of "Policy Guidance - Technology Empowerment - Mechanism Innovation - Practical Implementation," and combining the requirements of the "Opinions on Deepening the Integration of Industry and Education in the Home Economics Service Industry" with the core concept of "Post-Course-Competition-Certification-Training-Innovation," a digital twin-empowered training model for aligning home economics majors with industry-education is constructed.

### **3.1. Core Objectives**

The core objective is to cultivate high-skilled home economics talent with digital literacy, specialized skills, and professional literacy. It aims to achieve "three precise alignments": precise alignment between talent training specifications and industry job requirements, precise alignment between the curriculum system and occupational standards, and precise alignment between the teaching process and service procedures, promoting the transition of industry-education integration from "shallow cooperation" to "deep integration."

## **3.2. Constituent Elements**

### **3.2.1. Diverse Participating Entities**

Include educational institutions, home economics enterprises, industry associations, and government departments. Institutions are the main body for talent training, enterprises provide job requirements and practical resources, industry associations set standards and evaluation basis, and government departments provide policy support and resource coordination.

### **3.2.2. Digital Twin Technology Support**

Encompasses virtual training platforms, data collection and analysis systems, virtual-physical interaction terminals, etc., to achieve functions such as scenario simulation, process monitoring, data sharing, and intelligent evaluation.

### **3.2.3. Integrated Training Process**

Integrates the six key links of "Post, Course, Competition, Certification, Training, Innovation," forming a closed-loop process: "Job Demand Analysis - Curriculum System Restructuring - Virtual Training Teaching - Skills Competition Verification - Vocational Certificate Acquisition - Enterprise Internship - Innovation Capability Cultivation."

## **3.3. Operational Mechanisms**

### **3.3.1. Dynamic Demand Feedback Mechanism**

Through the digital twin platform, real-time data on job changes and skill demands in home economics enterprises are collected. A joint school-enterprise committee regularly analyzes demand changes and dynamically adjusts the talent training plan.

### **3.3.2. Virtual-Physical Integrated Teaching Mechanism**

Adopt a blended teaching model of "Virtual Simulation + Real-Scenario Practical Training." Basic skill training is completed on the virtual platform, while comprehensive ability enhancement is achieved through enterprise internships. The two are seamlessly connected through the data platform.

### **3.3.3. Collaborative Education Guarantee Mechanism**

Establish an operation team for the digital twin platform jointly built and managed by schools and enterprises, clarifying the responsibilities of all parties in resource investment, teaching implementation, evaluation, and assessment, forming a collaborative mechanism with shared benefits and responsibilities.

## **4. Optimization Strategies for Digital Twin-Empowered Alignment of Home Economics Majors with Industry-Education**

### **4.1. Restructuring the Curriculum System to Align with Industry Needs**

#### **4.1.1. Modular Curriculum Setup**

Based on the competency requirements of core positions in the home economics industry (elderly care, maternal and infant care, household management, etc.), construct a modular curriculum system comprising "Public Basic Courses + Professional Core Courses + Digital Skills Courses + Practical Training Electives."

#### **4.1.2. Integrating Digital Skills Content**

Add courses such as smart home operation, digital management of home economics services, and online service platform operation. Infuse digital skills throughout various

professional courses to enhance students' digital literacy.

### **4.1.3. Aligning with Occupational Standards and Certifications**

Refer to the occupational classification system and standards of the home economics service industry. Integrate the certification requirements of "Home Economics Credit Check" and the assessment content of vocational skill level certificates into the courses, achieving "Course-Certificate Integration."

## **4.2. Innovating Virtual-Physical Integrated Teaching Models**

### **4.2.1. Virtual Simulation Teaching**

Use digital twin technology to construct high-fidelity virtual service scenarios. Students can conduct full-process simulation training from basic operations to complex cases. The platform automatically records the operation process and generates personalized feedback.

### **4.2.2. Integrated Teaching of Post-Course-Competition-Certification-Training-Innovation**

Design teaching projects oriented towards job demands. Integrate skills competitions, vocational certificate examinations, enterprise training, and innovation and entrepreneurship training into the teaching process. Use the virtual platform to organically connect all links.

### **4.2.3. Remote Collaborative Teaching**

Leverage the digital twin platform to invite industry experts and enterprise technical backbone staff to conduct remote teaching and training guidance, breaking time and space constraints and sharing high-quality teaching resources.

## **4.3. Optimizing School-Enterprise Collaborative Education Mechanisms**

### **4.3.1. Co-building Digital Twin Training Platforms**

Institutions and leading home economics enterprises jointly invest in building digital twin training bases for home economics services, integrating resources from pan-home service industries like elderly care and childcare to achieve full coverage of training scenarios.

### **4.3.2. Building Dual-Quality Teaching Teams**

Establish a "School-Enterprise Shared Faculty Database" through the digital twin platform. Institutional teachers undertake internships in enterprises, and enterprise technical backbone staff conduct online teaching via the platform, enhancing the practical ability of the teaching faculty.

### **4.3.3. Constructing City-Wide Industry-Education Consortiums**

Relying on regional home economics industry clusters, form city-wide home economics industry-education consortiums by uniting local institutions, enterprises, and community service organizations to achieve resource sharing and complementary advantages.

## **4.4. Improving the Data-Driven Evaluation System**

### **4.4.1. Multi-Dimensional Evaluation Indicators**

Construct a four-dimensional evaluation indicator system covering "Theoretical Knowledge + Practical Skills + Digital Literacy + Professional Literacy." The practical skills evaluation combines virtual training data and enterprise practical assessment results.

#### 4.4.2. Process-Oriented Evaluation Methods

Utilize the digital twin platform to collect comprehensive data on students' learning processes, training operations, and job performance. Adopt a combination of formative and summative evaluation to comprehensively reflect students' ability levels.

#### 4.4.3. Industry-Education Alignment Assessment

Establish an industry-education alignment evaluation model, conduct regular assessments from dimensions such as talent training quality, enterprise satisfaction, and industry recognition, and dynamically optimize the training plan.

### 5. Conclusion and Outlook

Digital twin technology provides a new technical path and practical paradigm for solving the challenges of aligning home economics majors with industry-education. The digital twin-empowered training model constructed in this paper, through curriculum system restructuring, teaching model innovation, collaborative mechanism optimization, and evaluation system improvement, achieves precise alignment between talent training and industry needs, providing a feasible solution for cultivating high-skilled talent in home economics majors.

Future research can further deepen the development of application scenarios for digital twin technology in home economics majors, strengthen the intelligent upgrade of virtual training platforms, explore the integrated application of technologies such as "Digital Twin + Artificial Intelligence" and "Digital Twin + Blockchain," while accumulating more empirical cases to provide richer practical experience for the digital transformation of industry-education integration in vocational education. With increasing policy support and the deepening of technology application, digital twins are bound to promote the industry-

education integration of home economics majors towards higher quality and deeper levels, providing solid talent support for the high-quality development of the home economics service industry.

### Acknowledgments

This work was supported by the 2024 Education and Teaching Reform Research Project of Chongqing Vocational Institute of Commerce (Grant No. SWJWJG202428).

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