



How Can Virtual Simulation Be Used in Ceramic Product Design Classes in the Republic of China

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Abstract. This paper explores the virtual simulation project “Ceramic Flower Ware Design and Production Process” under construction Virtual simulation experiments” and a hybrid teaching model between specific courses in ceramic product design. At this point, there are few studies have been carried out with regards to this particular topic. The objective of this study is to review the different practices between Western countries and the Republic of China. The hybrid teaching mode explores the research methods and technical routes of virtual simulation experiments of the module. The existing scientific research data, the construction logic between virtual simulation and the discipline system of ceramic product design course is clarified. Taking the virtual exhibition hall of the university’s “Zhen lu in Flight” online graduation design as a breakthrough, the application research of the virtual display platform of characteristic achievements of university design was explored. The findings indicate that the virtual simulation and ceramic product design teaching and discipline logic system seems important in order to provide reference for product professional virtual simulation teaching and research, so as to promote the development of product design professional discipline.

Keywords: Ceramics design · Fujian ancient house · virtual simulation

1 Introduction

1.1 Scientific Significance and Application Prospects

In order to proactively respond to a new round of scientific and technological revolution and industrial transformation, the Ministry of Education of the People’s Republic of China has actively promoted the construction of “new engineering” since February 2017. “New engineering” requires the integration of industry and education, the transformation of education, the need to move from experience sharing to practical training, from formalism to focusing on practical results, from knowledge examination to ability cultivation, from single ability to system integration ability towards “formgiving” or form creation in design [1]. This construction puts forward higher requirements for students’ practical innovation and ability to solve complex problems, and also puts forward unprecedented high requirements for practical teaching in colleges and universities. In

such an educational context, with the support of the vigorous development of information technology, virtual simulation technology has developed rapidly in college teaching. Virtual simulation teaching uses virtual reality technology and simulation technology to construct unreal conditions and scenes, realistic operation objects and learning content, and flexible and diverse interactive links, making efficient, safe, economical and completely open teaching and learning possible including design thinking knowledges such as product emotion, product form identity, human cognition and behavior [2–4], which is expected to become the third teaching mode in addition to theoretical teaching and practical teaching, and will become the development direction of educational reform in the information age and an important measure for practical education informatization [5]. Virtual simulation teaching is a new teaching mode emerging under the background of education informatization, which will continuously promote teaching reform and promote the improvement of education quality [6].

1.2 Research Trends at Home and Abroad

1.2.1 Status Quo of Virtual Simulation Experiments in Foreign Universities

Foreign research on virtual simulation technology started early and was widely used. In 1989, American scholar William Wolfe first proposed the concept of a virtual laboratory [7]. After more than 30 years of construction, the virtual laboratory carried out in developed countries has been popularized to the public, and the construction and research of virtual laboratory have been carried out in major scientific research institutions and colleges and universities, and applied to scientific research and teaching [8]. The “International Education Informatization Horizon Report” released by the New Media Consortium (NMC) on an annual and sub-series basis is regarded as the vane of international education informatization construction and development. The report believes that virtual simulation teaching will become an important direction for domestic and foreign education circles to reform traditional teaching and improve the quality of talent training in the future, and is one of the important leading means of modern education, so it has attracted the attention of education circles around the world [9].

The British Open University laboratory application network, virtual reality and other technologies have developed virtual instrument sharing projects, which can realize all laboratory functions online, students can download virtual instrument software for online experiments, or use remote control instruments to control experiments. Yale University in the United States takes advantage of the immediacy, participation, situationality, ubiquity, and pleasure of mobile experiments, using tablet computers to complete molecular biology, cell biology, developmental biology and other course experiments, and teachers share resources such as data and images obtained from the central laboratory digital microscope with students through mobile applications on iPad. The Star CAVE virtual reality system developed by the University of California, San Diego, can display a three-dimensional virtual reality model of the Jordanian fortress in the tenth century BC, and students can use a handheld controller to walk through the fortress, rotate objects or make bird’s-eye observations in the sky, each time it takes a month to test, record and analyze the stereoscopic data of the virtual space, and use this data to build a simulation model of the entire fortress to solve the mystery of the architecture and function

of this giant fortress. The University of Redlands, Australia, uses tablet computers that are portable, high-resolution displays and touch screens to replace bulky experimental instruments, video equipment and other expensive tools for field teaching, taking and annotating terrain pictures, collecting and sharing rock data, quickly obtaining reference materials, and recording and analyzing collected data. IE Business School in Madrid, Spain, uses educational game software called "10 Downing Street" to teach students to learn and understand the complexities of global economic policies, think at a higher level, and develop practical skills to solve pressing problems in related fields.

According to the above analysis of literature, materials and network information on the teaching application of foreign universities in related fields, Wang Weiguo and others believe that there are 10 kinds of information technology used in virtual simulation experimental teaching abroad, including: multimedia technology, human-computer interaction technology, visualization technology, simulation technology, virtual reality technology, virtual simulation technology, augmented reality technology, virtual world, 3D printing technology, remote appearance technology [10], and it is clear that foreign universities use information technology to promote experimental teaching reform is a new trend in their teaching development.

1.2.2 Status Quo of Virtual Simulation Experiments in Domestic Universities

The application of virtual simulation teaching in China is slightly later than that of foreign countries, but it has developed rapidly. In recent years, the Ministry of Education has successively issued a series of policies to vigorously support and promote the research of virtual simulation experimental teaching projects. The Department of Higher Education of the Ministry of Education clearly pointed out in its "Notice on Carrying out the Construction of National Virtual Simulation Experimental Teaching Center" (Education High School Letter [2013] No. 94): The task of virtual simulation experiment teaching is to build a highly simulated virtual experimental environment and experimental objects, realize teaching functions that real experiments do not have or are difficult to complete, and provide reliable, reliable and comprehensive training when involving high-risk or extreme environments, unreachable or irreversible operations, high cost, high consumption, large-scale or comprehensive training, safety and economic experimental projects, etc. [11]; The Notice of the Ministry of Education on the Construction of the National Virtual Simulation Experimental Teaching Project (Jiao Gao Han [2018] No. 5) pointed out: The National Virtual Simulation Experimental Teaching Project is an important measure to promote the integration of modern information technology into the experimental teaching project, expand the breadth and depth of experimental teaching content, extend the experimental teaching time and space, and improve the quality and level of experimental teaching [12]; In 2019, the Ministry of Education issued the Implementation Opinions of the Ministry of Education on the Construction of First-class Undergraduate Courses, which clearly stated that about 1,500 national virtual simulation experimental teaching first-class courses should be completed within three years [13]. In this context, the construction of virtual simulation experimental teaching projects in various universities is in full swing.

At present, there are a total of 3,250 experimental teaching projects on the national virtual simulation experimental teaching course sharing platform, covering 61 subject

categories. Among them, the experiments related to ceramic product design are mainly concentrated in kiln firing, and there are about 20 experimental projects.

The importance of virtual simulation teaching for design majors is self-evident. Design students should not only systematically learn the basic knowledge of various majors, but more importantly, apply this knowledge to practical and solve real-world problems. The application of virtual simulation technology in ceramic product design is becoming more and more mature, and the virtual platforms related to ceramics are as follows, Zhengzhou University of Light Industry Jun porcelain firing virtual simulation experimental teaching platform, used to experience Jun porcelain firing technology. Bei bu Gulf University's Nixing pottery kiln variable firing process virtual simulation experimental platform is used to experience the Nixing pottery kiln variable firing process. South China University of Technology ceramic product kiln firing virtual simulation experimental platform, used to experience ceramic product kiln firing technology. Hunan Institute of Technology Yue zhou kiln firewood firing process virtual simulation experimental teaching platform, used to experience Yue zhou kiln firewood firing process. The above virtual projects are all aimed at the pottery firing technique, and there is no design and production process for pottery for the time being.

1.3 Basis for Establishing the Topic

Through the academic combing of virtual simulation experimental teaching at home and abroad and the national virtual simulation experimental project research, scholars have realized that virtual simulation is the development trend of experimental teaching, which is very important for any major, especially for design majors. Its research mainly focuses on the construction of virtual simulation experimental projects and the specific application of a virtual simulation technology, and there are a certain number of academic research in virtual simulation and design, but there are few academic analyses for ceramic product design courses.

Under the composite background of large-scale online teaching brought about by the new crown pneumonia epidemic and the country's vigorous advocacy of higher education informatization construction, under the large-scale application of virtual simulation experimental teaching in recent years, and under the establishment of the Virtual Simulation Experimental Teaching Center for Life Aesthetic Design of our school, it is possible to explore the role of virtual simulation in ceramic product design teaching in professional education and experimental education, and provides strong support.

1.4 Features and Innovations

1.4.1 Innovation of Research Content

In the past, the research of scholars mostly focused on virtual simulation technology and ceramic firing, and rarely extended to the logical construction of the discipline system of ceramic product design, nor did they pay much attention to the construction of the emerging exhibition method, that is, the construction of the virtual exhibition hall of ceramic product design graduation design.

1.4.2 Innovation of Research Perspectives

Starting from the construction of specific virtual simulation experimental projects, this paper clarifies the implementation path of virtual simulation in professional courses, and provides students with a new way to learn the design and production of ceramic products. Then, by combing the literature and the existing experimental projects of the platform, the relationship between virtual simulation and ceramic product design courses is obtained. Finally, combined with the application of modern information technology, it provides a new way for graduation design exhibition.

2 Existing Conditions

2.1 There is a Basis for Research Work

The product design of professional virtual simulation projects and online exhibition hall construction are based on the provincial virtual simulation experimental center "life Aesthetic Design Virtual Simulation Experiment Teaching Center." Next, there are professional cooperative R&D partners—Xiamen 3D Cloud Technology Co., Ltd., and with products Two virtual simulation experimental projects related to the design major, one of which is the "Zhen lu in Flight" online virtual graduation exhibition hall2020. The construction was completed and put into use at the graduation time of that year, another "Ceramic Flower Ware Design and Production Process." Taking the design of cultural and creative products in Fuzhou San fang and Seven Alleys as an example, the virtual simulation experiment (tentative) project is currently under intensive construction, and is expected to be put into use at the end of this year and the beginning of next year products Applied research in the design profession provides data and technical support.

2.2 There are Already Scientific Research Project Results

Zhang Xiao, a member of the project team, whose project "Exploration of the Deep Integration Path of Virtual Simulation and Environmental Design" was approved as the 2021 Fujian Province Young and Middle-aged Teachers Education and Research Project (Science and Technology), starting from the specific course, to explore the virtual simulation project under construction "Fuzhou Water Pavilion Architectural Culture and Courtyard Space Virtual Simulation Experiment (Tentative)" blended teaching models with specific courses in environmental design, which provides an important reference for the application of virtual simulation experiments in ceramic product design courses.

2.3 Collaboration

Xiamen 3D Cloud Technology Co., Ltd. provides information technology services for the virtual simulation experiment project of our school through public bidding, the company was established on November 19, 2015, is a professional 3D digital high-tech enterprise integrating equipment production, sales, service and Internet operation, providing a research channel for the project team members to understand the application research of virtual simulation experiment in ceramic product design courses.

3 Research Content

This research content explores a construction logic combining virtual simulation with ceramic product design courses (see Fig. 1). Path exploration has been looked into the 3 variables such as courses, system and project. The courses are focusing on pattern exploration through pottery design, knowledge learning and platform building. Moreover, the system is focusing on the path to fusion through foundation course, backbone course and personality course. Finally, the project is focusing on the way to show such as virtual showroom and graduation design exhibition.

3.1 Explore Blended Teaching Models Integrated with the Curriculum

This article takes virtual simulation experimental teaching as the starting point, takes the core course of product design “Ceramic Product Design” as the platform, relies on the virtual simulation experimental teaching center of school life aesthetic design, and combines General Secretary Xi Jinping’s important instructions on the protection of historical and cultural heritage and what he emphasized during his inspection in Fujian Under the background of “treating ancient buildings, old houses and old neighborhoods with a cherished heart and a respectful heart”, the construction of the “Ceramic Flower Ware Design and Production Process - Taking Fuzhou San fang and Seven Alleys Cultural and Creative Product Design as an Example Virtual Simulation Experiment (Tentative)” project, combined with a variety of teaching methods and means, to achieve the teaching goal of “understanding history, being able to design, and re-inheriting”, only by participating in the experimental construction of virtual simulation can we understand thoroughly and speak in place.

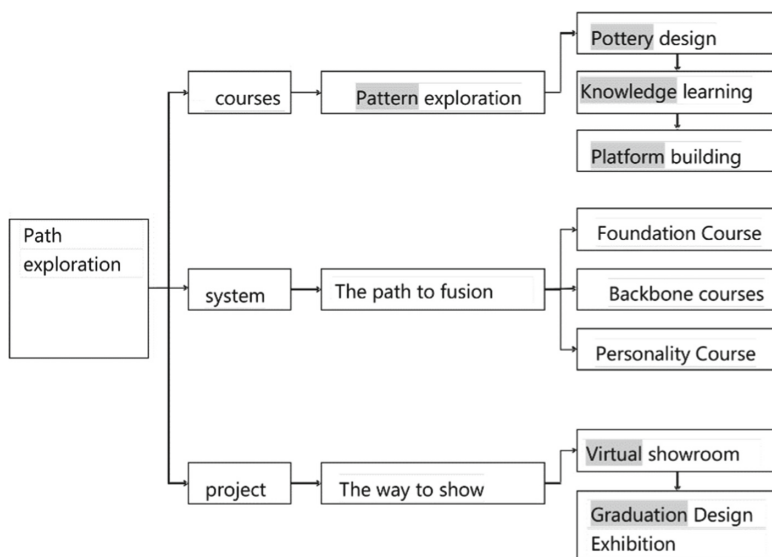


Fig. 1. Construction logic combining virtual simulation with ceramic product design courses

3.2 Explore the Innovation Path of Deep Integration with the Discipline System

Combined with the characteristics of the product design industry and the characteristics of ceramic product design courses, through the analysis of the virtual simulation experiment construction effect and technical means of major platforms, the virtual simulation construction system of innovative disciplines featuring “art discipline + information technology” is studied, and the importance of logical construction is clarified.

3.3 Explore New Ways of Presenting Works in Comprehensive Practice that are Closely Related to the Exhibition Space

As the general inspection form of students’ graduation link, graduation design examines the comprehensive use of professional knowledge by students in the entire course learning stage, which can be said to be the best business card for students, through virtual reality, three-dimensional modeling and other digital technology means to build a virtual exhibition hall, build an online “multi-dimensional reality experience” function, flexibly display students’ graduation works, cross-regional publicity of students’ comprehensive design ability, bring new online exhibition experience to the audience from a new perspective, and bring new ways for enterprises to understand talents from a new window.

4 Research Methods

For this paper, the research ideas are qualitative, statistics, qualitative and theory. Moreover, the framework is focusing on blended teaching, path to deep integration, a new way of showcase space and virtual simulation converges with design. Finally, research methods were based on case studies lesson learned, literature search statistical analysis, case studies lesson learned and comparative studies 1 and 2 (see Fig. 2).

The hybrid teaching mode explores the research methods and technical routes of virtual simulation experiments of the module (see Fig. 3). The research flow process consists of several step such as: 1) with virtual simulation experiment of ceramic flower design and production process, 2) watch the video to know the background, process and purpose of the experiment, 3) experiment preparation, 4) start experimenting, 5) considering whether to submit or not, if it is no, the process needs looping at the previous phases respectively, and 6) if yes, it can be review in the lab.

5 Specific Steps

The specific implementation steps are divided into three steps:

Firstly, it cooperated with Xiamen 3D Cloud Technology Co., Ltd. to complete the construction of the project “Design and Production Process of Ceramic Flower Ware - Taking the Design of Cultural and Creative Products in Fuzhou Sanfang and Seven Alleys as an Example Virtual Simulation Experiment (Tentative)”, and conducted in-depth research on its application effect, summarized the demand for virtual simulation technology in course theory, experiment and practical training teaching, and further

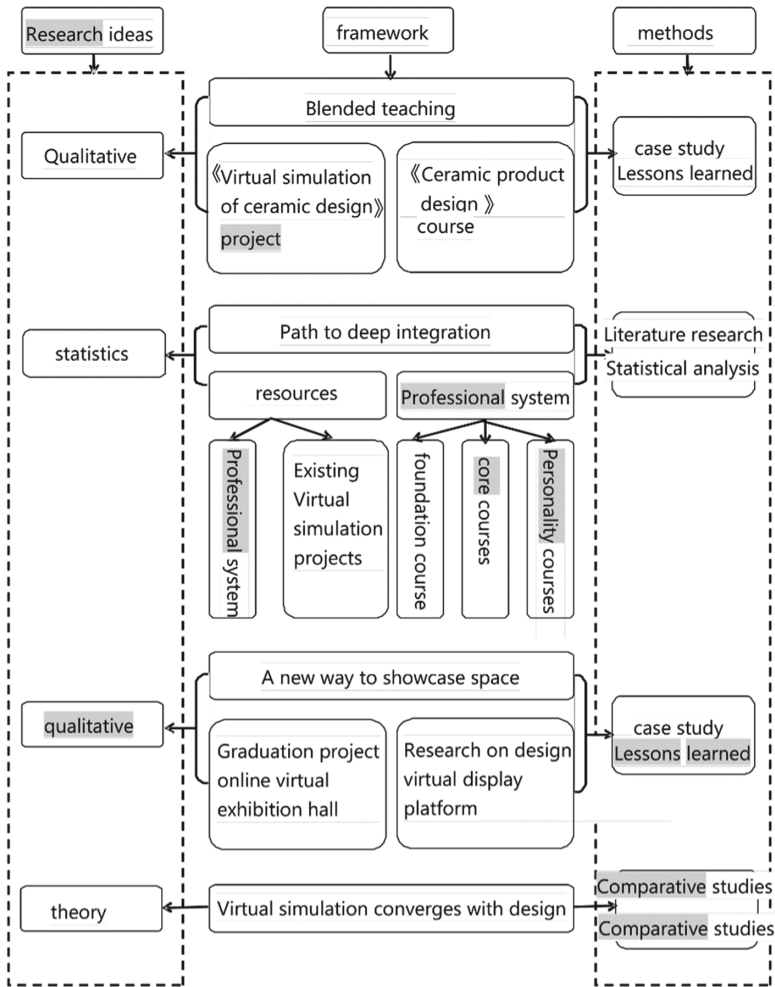


Fig. 2. Overall research methods and technical routes

analyzed the specific application of virtual simulation in the teaching of ceramic product design courses from the perspectives of experience works and deliberation schemes.

Then, the teaching content, methods, teaching effects and related subjects of the existing virtual simulation experiments of the product design major are analyzed, and the construction logic between the virtual simulation and the teaching system of the major is sorted out. With the application of courses of different nature as the starting point, fully organize virtual simulation technology and resources, enrich and improve the existing virtual simulation teaching system of product design majors, give the development direction of virtual simulation experiment construction, and finally make virtual simulation better serve the product design profession to cultivate high-level talents.

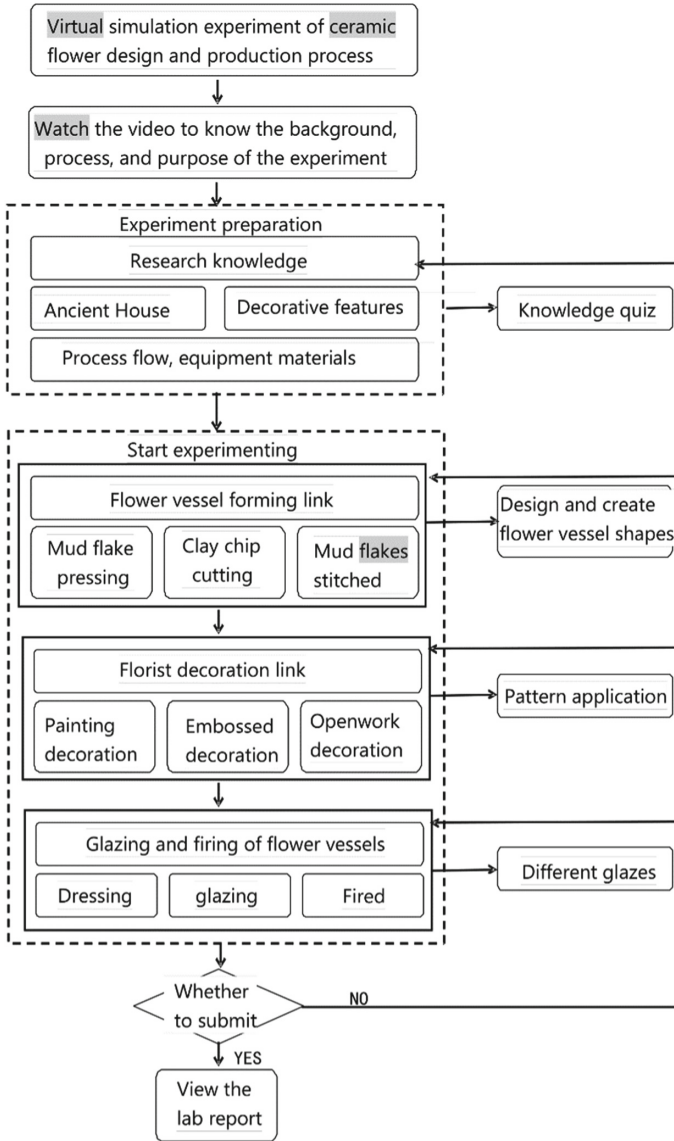


Fig. 3. The hybrid teaching mode explores the research methods and technical routes of virtual simulation experiments of the module

Finally, the online virtual graduation exhibition hall of “Zhenlu Yufei”, which was completed and put into use in 2020, analyzes the application research of the existing virtual exhibition hall in various universities, expounds the design principles of the virtual exhibition hall of graduation design works from the aspects of ideas, design, function and technology, and sorts out the scientificity and rationality of the application of virtual exhibition hall in the design profession, in order to provide reference and guidance for

virtual exhibition hall design, especially the exhibition hall design of exhibition graduation design works. Strengthen the application effect of virtual simulation in product design professional exhibition exhibitions.

6 Concluding Remarks

6.1 Scientific and Technical Problems to be Solved

The project “Design and Production Process of Ceramic Flower Ware - Virtual Simulation Experiment (Tentative)” based on 3D simulation technology, multimedia technology and network technology is under construction and has become the basis and entry point of this paper, which adopts a service-oriented and scalable application architecture with good autonomy, interactivity and scalability. The platform architecture is divided into three layers, each serving its upper layer. It adopts the architecture pattern of combining CS and BS architecture. The data center builds data warehouses for user information, course libraries, typical experiment libraries, preview libraries, experimental data, model panorama databases, and question databases based on MySQL. The support layer supports business logic, which is divided into security management, service container, data management, and domain management, and supports user access and background analysis.

The teaching team needs to integrate academic materials, make virtual simulation scripts, clarify the steps of simulation, and sort out a clear idea. The technology team selects appropriate technical means for presentation based on the information and content provided by the teacher team. How to provide teaching information management, simulation experiment content management and class management services through the service layer, that is, the open virtual simulation experiment teaching management platform; How to use the simulation layer to transmit the rule data through the network to integrate and display the 3D scene and production content of ceramic product design and production; How to perform construction modeling, web page source code construction and meta analysis through remote servers, and finally present the beautiful picture rendered in real time to the user terminal are all issues that both parties need to focus on in the next virtual simulation experiment construction process, and the integration of teaching knowledge and information technology requires continuous correction and debugging to achieve the goal.

6.2 Benefit Analysis and Application Prospects

The characteristics, application effects, relationship between the virtual simulation experiment of ceramic product design and the discipline system and the future construction direction are sorted out to meet the requirements of the establishment of virtual simulation experiment teaching platform between universities to form a complementary and mutually beneficial open sharing mechanism, clarify the context, make overall planning, help allocate shared resources, and make ceramic product design courses in various universities Realize virtual simulation of online and offline hybrid teaching, save teaching resource consumption, reduce practical teaching costs, optimize teaching time,

get rid of the dangerous threat of on-site teaching, and enable schools to obtain excellent teaching, social and economic benefits.

Teaching in the mode of virtual simulation experiment is conducive to improving the innovative spirit and practical ability of college students, sharing and saving high-quality experimental teaching resources, coordinating the construction of information experimental teaching, meeting the teaching needs of ceramic product design courses and related majors, and helping full-time teachers achieve the goal of cultivating innovative talents through resource integration.

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