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Teaching Reform of Cultural and Creative Product Design Based on Virtual Reality (VR) Technology

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ABSTRACT

Under the influence of visual culture environment, today's product design teaching will gradually change from the traditional theoretical method dominated by traditional classroom teachers to a more diversified and digital student practice mode. This study applies virtual reality technology to the teaching course of cultural and creative product design, and is committed to developing new possibilities for product design courses. Creating virtual design course environment with virtual reality equipment. Create an immersive design experience. Make up for the deficiency of traditional curriculum methods, and let students enjoy cultural and creative works from a richer and more diverse perspective in the virtual environment, so as to effectively cultivate the core literacy of the subject. It has become an inevitable trend for virtual reality technology to enter the traditional classroom. It is hoped that through this research, problems can be found, rules can be summarized, and practical experience of curriculum teaching can be provided for future "internet plus" and "VR+" education.

KEYWORDS

Cultural and creative product design, Teaching reform, Virtual reality technology

INTRODUCTION

With the strategic transformation and upgrading from 'Made in China' to 'Smart Manufacturing in China' the Chinese State advocates promoting industrial development with cultural creativity. In order to cultivate talents needed for the development of cultural and creative industries, art colleges and universities have opened cultural and creative product design courses in many art-related majors. At present, as a professional core course, the teaching effect and training effect of cultural and creative product design courses course are not ideal, which affects the improvement of students' professional and technical level to a certain extent and is not conducive to the construction of a professional curriculum system. First of all, the traditional curriculum model of cultural creative product design mainly starts with basic knowledge, mainly taught by teachers and interspersed with some design practice links. Under this traditional teaching process, students cannot deeply understand course

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essence, and their enthusiasm for learning is not high. Second, as a pilot course, such as shape design, product semantics and other courses have insufficient relevance with cultural and creative product design courses. Students lack consistency in their knowledge cognition and cannot integrate several courses in the actual operation process, which seriously affects the teaching effect of the course. Third, the cultural creative product design curriculum follows the traditional teaching evaluation method of art designHowever, this type of evaluation is single-minded and dominated by teacher evaluation.

Virtual Reality (VR), abbreviated as VR in English, is an emerging information simulation technology in recent years. It realizes a high degree of simulation of the real world through computers and brings people a three-dimensional sensory experience from the perspectives of vision, hearing, smell, touch, etc. and then enables people to obtain an immersive dynamic perception experience (Akdere et al., 2021). The first advantage is interactivity. Interactivity means that people use virtual reality technology to conduct in-depth "communication" with design products, thereby promoting the breakthrough and development of product design teaching. In the teaching process of product design, teachers use virtual reality technology to allow students to touch and apply the products they design, and they can apply these products to different environments. At the same time, students can also obtain operational feedback in the virtual reality world, enhance the interaction between the design and the environment, and continuously adjust the orientation and environment of the product according to their own thinking changes; and finally, they can obtain a perfect interactive experience (Bogicevic et al., 2021).

The second is immersion. Immersion refers to the environment created by virtual reality technology, which has an absolute sense of reality (Cheng et al., 2022). Through the application of virtual reality technology, people will be immersed in the virtual environment as the masters of the virtual world and can get a real sensory experience. At the same time, people can also create various environments according to their own imagination and can feel every detail in the environment created by themselves. This is very beneficial for students to accurately grasp the relevant knowledge of product design (Dutton, 2021).

The third is imagination. Imagination is the driving force for people to create activities, and it is also one of the abilities that designers need to have, especially for product design courses. Teachers and students need to fully stimulate their imagination in the process of applying virtual reality technology so as to improve their experience level. In the process of applying virtual reality technology to carry out product design course teaching, teachers need to build a high-quality environment. If conditions permit, teachers can combine students' imaginations to achieve good teaching results through group cooperation (Fang et al., 2021). At the same time, they can also comprehensively enrich the teaching organization and teaching content, continuously optimize the virtual reality environment, and truly improve students' design skills.

Based on important theories such as system theory, product semantics, Chinese traditional aesthetics, and design psychology, the course of cultural and creative product design takes cultural and creative content as the core. Through learning, it helps students accurately integrate, analyze, and refine the connotation and symbolic significance of culture, guides students to complete the design and development of products, and helps them establish a complete thinking system and innovative methods of cultural and creative product design. As a practical core course of art design, the course of cultural and creative product design aims to cultivate professional innovative talents for modern cultural and creative industries. Based on the analysis of the course characteristics and current situation of cultural and creative product design, this paper introduces virtual simulation technology into classroom teaching; guides students to develop, innovate, and evaluate cultural and creative products with the help of virtual simulation technology; and discusses the specific reform and practice path of this course under the background of virtual simulation.

It is a new research topic to introduce virtual simulation technology into the education and teaching of this course. The powerful graphics change technology, geometric modeling technology, real graphics technology, human-computer interaction technology, animation generation, and other technologies of the virtual simulation system can help to establish an immersive interactive environment and generate a realistic virtual environment integrating vision, hearing, and touch. Students can naturally interact with the objects in the virtual environment with the help of equipment, complete the collection and recording of information, and help to improve the depth and breadth of classroom teaching. At the same time, students can participate in the construction of the virtual platform by making use of the knowledge they have learned, which will help improve students' learning enthusiasm and practical operation ability and promote the reform and construction of the scientific and complete curriculum system of this course.

LITERATURE REVIEW

Overview of Virtual Reality Technology

Virtual Reality (VR) is the construction of a virtual simulation system through the computer, so that the user is immersed in the virtual environment, and through the computer in the virtual space to deal with a variety of complex information and visualization of information.. At the beginning of virtual reality technology entering China, Qian Xuesen once translated the term Virtual Reality into "spiritual realm technology,"(Wang,2011) and the space created by virtual reality technology in the computer is called "spiritual realm." Therefore, virtual reality technology is also called "spiritual technology" (Godzik et al., 2021).

Virtual Reality is an immersive interactive technology with 3D, sensing and rendering techniques. Popular introduction refers to the virtual reality of vision, hearing, and touch into a relatively realistic real environment and enables the user to obtain a relatively natural and real experience with the help of certain viewing equipment; and it can interact with the scenery in the virtual environment so as to generate real feeling and visual experience (Hu, 2021). The use of virtual reality technology can effectively reduce the operational burden of users and improve work efficiency. There are four basic characteristics of virtual reality technology: multi-sensory, immersive (immersion), interactive, and conceptual (imagination) (Hou et al., 2019).

Generally speaking, a virtual reality system is composed of multiple systems, including a virtual environment system, a processing system of the computer used, and a display device (Han et al., 2016). And a variety of interactive feedback systems such as auditory system, tactile system, speech recognition system, taste system, tactile system and other different sensory systems (Hasanudin et al., 2021). Virtual environments and human-computer interaction are accomplished with the joint coordination of multiple systems. so as to restore the real experience of users in the virtual environment (Hui et al., 2022).

Virtual reality was first proposed by Ivan Sutherland in the international information processing Federation(Sutherland, 1968). With the development of computer technology, computer graphics, and communication technology and the demand of network display, virtual reality technology has been gradually accepted by the public. Virtual reality technology rose in the 1990s.

According to the research results of domestic and foreign researchers on VR technology, the virtual reality technology is divided into the following four types according to the number of participants and the form of participation (Jang et al., 2021):

1. Desktop Virtual Reality (DVR): The carrier of the desktop virtual reality system is a computer screen or other display, which connects the virtual world to the display screen; and the user uses different controllers in the real world. The characteristics of the desktop virtual reality system are that the system is simple in structure and low in production cost, which is convenient for market promotion; but at the same time, the user operates in the real world, so it is difficult to have a real experience for the user (Kumari et al., 2021).

2. Immersive VR: This system uses a variety of sensory tracking systems such as head-mounted devices and data gloves to bring most of the senses of the real experiencer into the virtual environment. It can make the experiencer have the illusion of being in the virtual world (Lyu et al., 2021). The most important feature of the system is to bring the various senses of the experience into the virtual environment, and it uses different sensory capture devices to separate the experience from the real world, eliminate external interference, and truly stay in the virtual world. The disadvantage is that the manufacturing cost of the system is relatively high and it is not easy to popularize (Lloyd & Haraldsdottir, 2021).
3. Distributed virtual reality system (Distributed VR): With the addition of the internet, the virtual environment is not limited to the independent use of local users, and multiple users can simultaneously enter the same virtual environment through the internet to achieve online real-time experience with multiple people.

Through the research on the above four different forms of virtual reality technology, it is found that although the desktop virtual reality system is simple and low in cost, its effect is limited. However, the technology of the augmented reality virtual system is not very mature at this stage, and the actual application will take some time. Therefore, in the field of education, the immersive virtual reality system or distributed virtual reality system can be applied; both of these can show good results and improve the quality of teaching.

Research on the Application Status of Virtual Reality Technology

Since the beginning of research and development, virtual reality technology has been applied to all walks of life with its powerful functionality and inclusiveness. Whether it is in a virtual environment to realize dangerous experiments in a real environment or to realize development and training in a virtual environment, virtual reality technology is undoubtedly a cheaper and safer method. Now virtual reality technology has been applied to all walks of life (Lin et al., 2021).

In terms of research and development innovation, virtual reality technology cannot only reduce the time required for research and development, but also reduce the cost of research and development. For example, in early 1998, Chrysler used virtual reality technology to make breakthroughs in the design of two new types of cars. For the first time, the designed new car was put into the production line directly from the computer screen, which means that the intermediate trial production was completely omitted. The addition of virtual reality technology not only helps companies save a lot of development costs (Qin et al., 2020), but also avoids a lot of design errors that may occur in real experiments when testing in a virtual environment. Using virtual reality technology, it is also possible to carry out car crash tests, conduct car hedging experiments in a virtual environment, and extract real experimental data through the simulated environment. Virtual reality technology can also be applied to the development of new materials. Testing the performance of new materials in a virtual environment can help one obtain the same data as in the real world, and a full range of experimental tests can be performed on new materials before they are manufactured.

Commercially, virtual reality technology can be used for product promotion and sales. For example, in the real estate industry, virtual house inspections can be carried out, and customers who buy houses can enter the buildings built in the virtual environment through the virtual reality system; and they can make decisions by feeling the real estate in the virtual environment (Schuemie et al., 2001). The same virtual technology has also been applied to tourism and other industries; in the virtual environment one can enjoy the famous scenic spots in various regions. The attractive effect of product promotion in the virtual environment is incomparable with the graphic promotion in reality.

In medical treatment, by establishing a 1:1 model of human beings in a virtual environment, it allows doctors to better understand the structural characteristics of the human body, and at the same time, in the virtual environment, it is possible to perform training on patients such as with surgery, which can be done well in surgical guidance (Shadiev et al., 2020).

In the military, the use of virtual reality technology to simulate war can enable soldiers to study the command mode in peacetime and have a more comprehensive understanding of war. It is also possible to conduct combat training of special arms such as the Air Force and the Navy through virtual reality technology. Before the start of the Gulf War in 1991, the U.S. military entered various natural environments in the Gulf region in VR and uploaded various data of the Iraqi army into the computer; and they conducted various combat plan simulations before setting the initial combat plan. Later, the development of actual combat was quite consistent with the simulation results (Vaghela et al., 2021).

In entertainment, virtual reality technology has now been widely used in the field of entertainment (Walters et al., 2022). The development of various virtual reality games can be said to be a new era of game development, and its immersive experience and thrilling adventure have raised the player's experience of the game to a new level (Wu et al., 2021). At the same time, with the blessing of virtual reality technology, many extreme sports can also be experienced in a virtual environment.

In education, a virtual campus is a 1:1 campus scene in which a real campus is established in a virtual environment (Xie et al., 2021). The real campus is browsed through a carrier, and it appears as a new media method. As early as 1996, Tianjin University, in On the SGI hardware platform, based on the VR ML international standard, a virtual campus was first developed to enable those who have not been to Tianjin University to appreciate the long-established and prestigious university in modern history. Through the combination of virtual reality technology and internet technology, more universities and even enterprises have begun to build virtual campuses (factories) for publicity (Xu et al., 2021). Virtual teaching and virtual reality technology are mostly used in the development of teaching mode. Through the characteristics of authenticity in virtual reality technology, a virtual simulation learning environment is established, which not only gets rid of the constraints of space in real teaching, but also allows students to have a real learning experience. Teaching simulation is a very valuable CAI model, which is widely used in teaching. For example, the geological crystallography learning system developed by China University of Geosciences uses virtual reality technology to realize the structural characteristics of crystals so that students can understand and learn more clearly.

METHODOLOGY

Flow Field Visualization Method in Immersive Augmented Reality Environment

With the help of virtual simulation technology media, this course constructs a multilateral interactive framework of product innovation user experience virtual simulation in the context of cultural and creative industries, avoids the one-sided cultural cognition of students in the stage of cultural element extraction, and redesign and the limitations of survey methods and data collection; it also promotes the scientificity of design methods and evaluation systems and builds a demand-oriented, systematic, and scientific curriculum group that conforms to the characteristics of art disciplines. Through the virtual simulation platform, a 3D cultural scene is built to help students deeply explore the cultural connotation and modern user needs in the virtual environment and store various technical knowledge and data required for product development so as to provide a scientific database with high validity and reliability for the course.

Immersive augmented reality is a technology that displays virtual graphics in the real space. When applied to the visualization field, it will not block the user's field of vision. When users work together, they can provide users with rich expressions such as collaborators' expressions, body movements, and vocal positions. The collaborative information can enhance the user's perception ability, effectively assist the user's work, and improve the user's collaborative efficiency. At present, there are still many difficulties in the application of immersive augmented reality technology in the field of flow field visualization. The flow field visualization method usually includes three processes: data mapping, data drawing, and data rendering. Head-mounted augmented reality devices need to be designed with portability in mind. They are usually equipped with chips that are lightweight but have low computing performance, so such devices cannot efficiently complete data mapping; and in immersive augmented reality environments, visualization results are in real space. The display position of the visual result should conform to the laws of fluid mechanics, so before drawing and rendering, it is necessary to accurately locate the display position of the visual result to ensure the correctness of the visual result. Aiming at the above problems, this chapter proposes an immersive augmented reality system architecture for flow field visualization and an automatic + manual streamline positioning method. Based on Microsoft's immersive augmented reality device Microsoft Hololens, the above method is implemented, and a flow pipe drawing method based on Unity Mesh is proposed to complete the drawing of streamlines and flow pipes.

Mesh is the basic unit of model representation, and Unity Mesh is the basic format for model storage and representation in Unity. Generally speaking, mesh refers to the mesh of the model. The 3D model is composed of polygons, while a complex polygon is actually composed of multiple triangular surfaces. Therefore, the surface of a 3D model is composed of a plurality of triangular surfaces connected to each other. In the 3D space, the set of points constituting these triangular surfaces and edges of triangles is mesh. The Unity3D engine can generate 3D models based on the 3D grid point set in Mesh and the connection relationship between grid points. Therefore, how to convert the point data with the associated relationship generated in the data mapping stage into the three-dimensional grid point set and the connection relationship between the grid points through calculation is the issue to complete the streamline drawing in the headset enhancement engine. The specific calculation method is as follows:

1. Read the streamline geometric data obtained by data mapping, and obtain the streamline point set, which includes the positions of all streamline points, and denote the point in the streamline point set as P(n), where n is the point in the streamline point set The index of, whose coordinates are (Xn, Yn, Zn), then the next point is P(n+1), and the previous point is P(n-1).In this approach, the flow tube is considered as a three-dimensional figure, formed by successive movements (translation, rotation, scaling) of regular polygons. If the radius of the flow tube is smaller than the limit length that can be observed by the human eye, the drawing result is It can be regarded as a streamline, otherwise it is a flow tube.

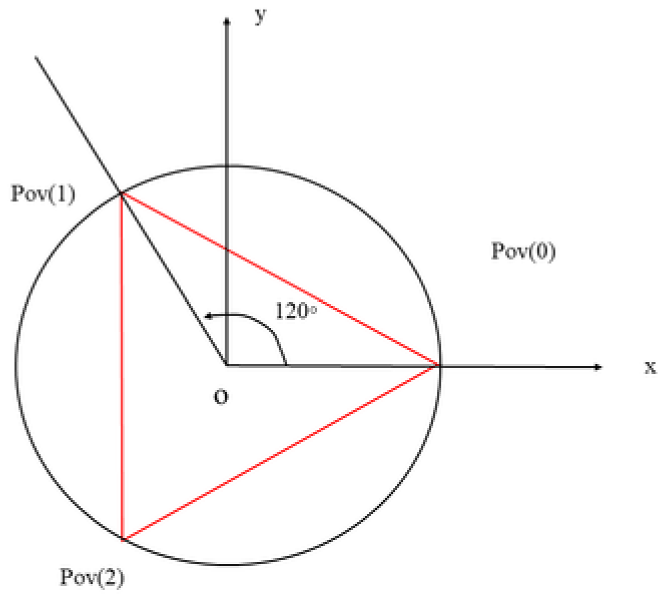
First, the initial regular polygon is constructed with (0, 0, 0) as the center point, as shown in Figure 1 (N is 3 in the figure, since the Z axis of the initial regular polygon is 0, it is represented by a two-dimensional plan), and the radius of the flow pipe is set as r; and the number of polygon sides is N. Then the number of points of the regular polygon is N, and the number of each point of the initial regular polygon is "m"; then the coordinates of each point of the initial regular polygon can be expressed as Pov(m):

$$P_{ov(m)} = \left(\cos\frac{m*2\pi}{N}, \sin\frac{m*2\pi}{N}, 0\right) \tag{1}$$

Its forward vector is (0, 0, 1) and its up vector is (0, 1, 0).

Coordinate transformation of the initial regular polygon between each streamline point: from the streamline point coordinates P(n), the translation matrix required to transform the initial regular polygon to the grid polygon at this point can be obtained, expressed as Mt (n):

Figure 1. Schematic diagram of initial regular polygon generation



$$\boldsymbol{M}_{t(n)} = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ x_n & y_n & z_n & 1 \end{pmatrix} \tag{2}$$

In order to ensure the naturalness when the flow tube is bent, the initial regular polygon is rotated as follows:

Calculate the direction vector of the streamline, expressed as D(n):

$$\mathrm{D}_{(n)} = P_{(n+1)} - P_{(n)} \tag{3}$$

From D(n), D(n-1), the forward vector F(n) of the mesh polygon at each point of the streamline is calculated:

$$\mathrm{F}_{(n)} = \mathrm{D}_{(n-1)} + \mathrm{D}_{(n)} \tag{4}$$

Assuming that the upward vector U(0) of the polygon at the initial point of the streamline is (0, 1, 0), the upward vector U(n) of each point of the streamline can be calculated in turn according to Eq. (5):

$$\mathrm{U}_{(n)} = \mathrm{F}_{(n)} \times (\mathrm{U}_{(n-1)} \times \mathrm{F}_{(n)}) \tag{5}$$

Rotate the initial regular polygon to ensure that its upward vector and forward vector are the same as Un,n, and the rotation quaternion R(n) of this point can be obtained; and its value is expressed as Ωn, αn, βn, γn.

From R(n), the rotation matrix required to transform the initial regular polygon to the mesh polygon at this point can be obtained, which is expressed as Mr(n); and its columns are respectively expressed as A1, A, A3, A4:

$$\boldsymbol{A}_1 = \begin{pmatrix} 1-2\beta_n^2 - 2\gamma_n{}^2 \\ 2\alpha_n\beta_n + 2©_n\gamma_n \\ 2\alpha_n\gamma_n - 2©_n\beta_n \\ 0 \end{pmatrix} \tag{6}$$

$$\boldsymbol{A}_2 = \begin{pmatrix} 2\alpha_n\beta_n - 2©_n\gamma_n \\ 1-2\alpha_n{}^2 - 2\gamma_n{}^2 \\ 2\beta_n\gamma_n + 2©_n\alpha_n \\ 0 \end{pmatrix} \tag{7}$$

$$\boldsymbol{A}_3 = \begin{pmatrix} 2\alpha_n\gamma_n + 2©_n\beta_n \\ 2\beta_n\gamma_n - 2©_n\alpha_n \\ 1-2\alpha_n^2 - 2\beta_n{}^2 \\ 0 \end{pmatrix} \tag{8}$$

$$\boldsymbol{A}_4 = \begin{pmatrix} 0 \\ 0 \\ 0 \\ 1 \end{pmatrix} \tag{9}$$

$$\boldsymbol{M}_{r(n)} = (\boldsymbol{A}_1 \quad \boldsymbol{A}_2 \quad \boldsymbol{A}_3 \quad \boldsymbol{A}_4) \tag{10}$$

From the flow pipe radius r, the scaling matrix required to transform the initial regular polygon to the mesh polygon at this point can be obtained, expressed by Ms(n):

$$\boldsymbol{M}_{s(n)} = \begin{pmatrix} r & 0 & 0 & 0 \\ 0 & r & 0 & 0 \\ 0 & 0 & r & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix} \tag{11}$$

Using the above matrix to transform the coordinates of the initial regular polygon, the coordinates of each point of the grid regular polygon at each point of the streamline can be obtained, which is expressed as Pv(m.n), where m is the point number on the regular polygon and n is the streamline point number:

$$P_{v(m,n)} = \boldsymbol{M}_{\boldsymbol{t}(n)} * \boldsymbol{M}_{\boldsymbol{r}(n)} * \boldsymbol{M}_{\boldsymbol{s}(n)} * \boldsymbol{P}_{\boldsymbol{ov}(\boldsymbol{m})} \tag{12}$$

The grid connection rules are shown in Figure 2: the figure shows the N=3 flow pipe grid generated based on two points, and the triangular patches of the grid are ABD, DBE, BCE, EFC, CAF, and FDA.

Parameter Configuration Panel Based on User Gaze and Gesture

For the requests of the visualization counting ways, parameter configuration panel based on user gaze and gestures is implemented in combination with the QT development framework. The interactive panel plane equation is:

$$w_1 * \left(x - o_1\right) + w_2 * \left(y - o_2\right) + w_3 * \left(z - o_3\right) = 0 \tag{13}$$

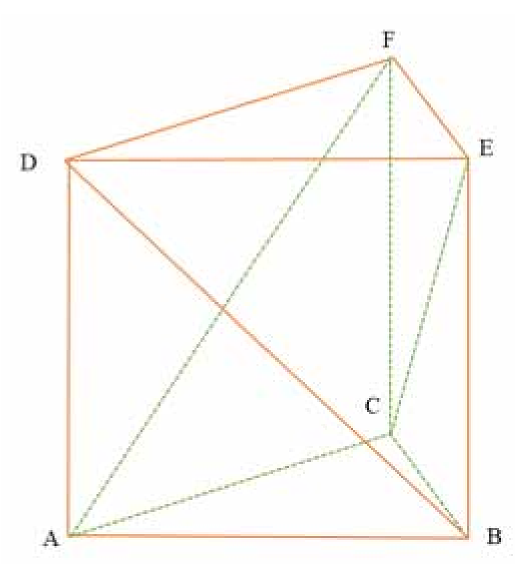
Intermediate variable t:

$$t = \frac{\sum_{i=1}^{3}\left(o_i - a_i\right) * w_i}{\sum_{i=1}^{3} w_{i*} r_i} \tag{14}$$

Put t into Eq. (1), then users will get the B of the interaction panels, and the number is (x,y,z). Based on the changing way of the three-dimensional coordinate one, B will turn from the world one into the UWV one. Therefore, B on the UV coordinate will be gained; it is here below (u, w, v):

$$\begin{pmatrix} u \\ w \\ v \\ 1 \end{pmatrix} = \begin{pmatrix} u_1 & u_2 & u_3 & 0 \\ w_1 & w_2 & w_3 & 0 \\ v_1 & v_2 & v_3 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} 1 & 0 & 0 & -o_1 \\ 0 & 1 & 0 & -o_2 \\ 0 & 0 & 1 & -o_3 \\ 0 & 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} x \\ y \\ z \\ 1 \end{pmatrix} \tag{15}$$

Figure 2. Schematic diagram of grid connection rules



RESULT ANALYSIS AND DISCUSSION

GG Immersive Flow Field Visualization Natural Interaction Model Evaluation

The consequences will be in the F3 about the comparing data. The research has compared the time on an average basis for the users who are undergoing different tasks. The interaction method in the immersive environment outperforms the one acted out by the old and traditional way. What is more, for the tasks along with more precision and more 3D interaction, the advantages will be stronger than before, as shown in Figure 3.

F4 will show the differences between interaction trouble for the interaction method. The interaction difficulty uses the method of user subjective survey to collect data. For the GG model, 18 users think its interaction difficulty is easy or very simple, two users think its difficulty is medium, and the average is 1.7. Overall, the handle interaction method is slightly better than GG in interaction difficulty, and both interaction methods are better than the traditional two-dimensional interaction method in interaction difficulty, as shown in Figure 4.

F4 has shown the differences of the levels of trouble degrees of every way for interaction with the method of same evaluation way for interaction trouble. For the model GG, 18 ones consider it to be easy, and two of them consider it to be not that easy. The average part is 1.8. For 2D ways, eight think it is easy, and 12 consider it is at a middle level. Three ones think it is very hard, as shown in Figure 5.

Figure 6 compares the user preferences for various interaction methods. Among them, 11 users chose the GG model, seven users chose the handle interaction method, and only two users chose the traditional two-dimensional interaction method.

Compared with the commonly used handle interaction, although the GG model is slightly inferior to the handle in terms of interaction efficiency due to the problem of gesture mistouch and gesture jitter, its natural interaction method can effectively reduce the user's learning cost and enable users to devote more energy to the game. Depending on the analysis itself, it can effectively improve user fatigue through a multi-channel approach. Therefore, the GG model can become an effective choice for immersive flow field visualization interaction.

Figure 3. Schematic diagram of the average task time

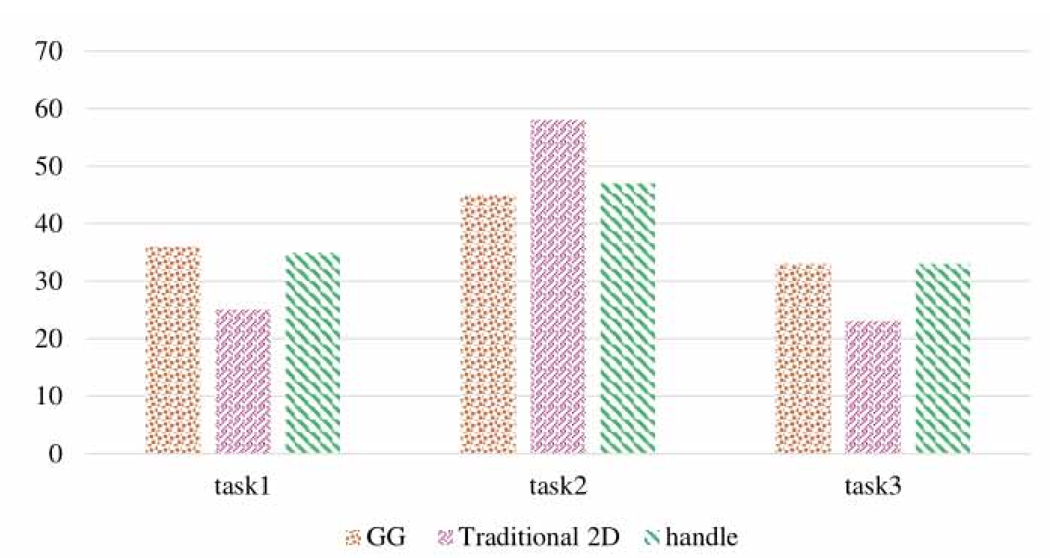


Figure 4. Schematic diagram of interaction difficulty

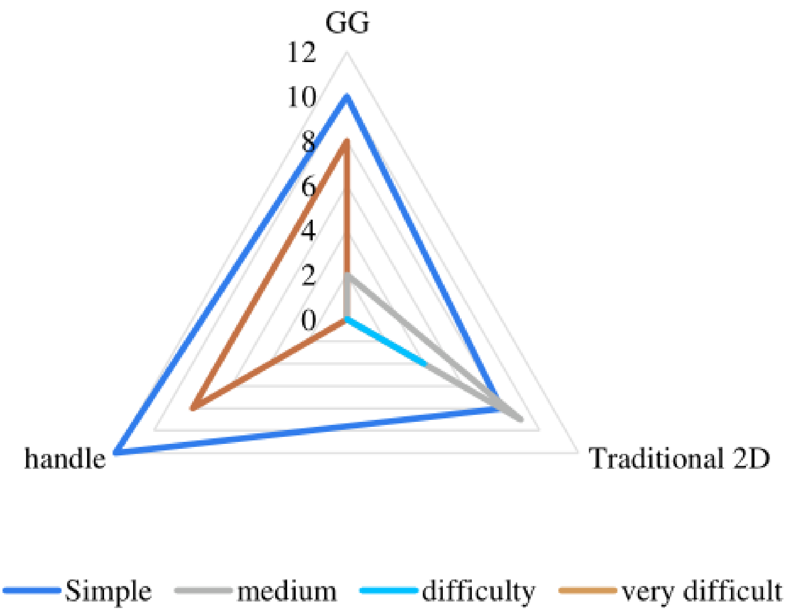
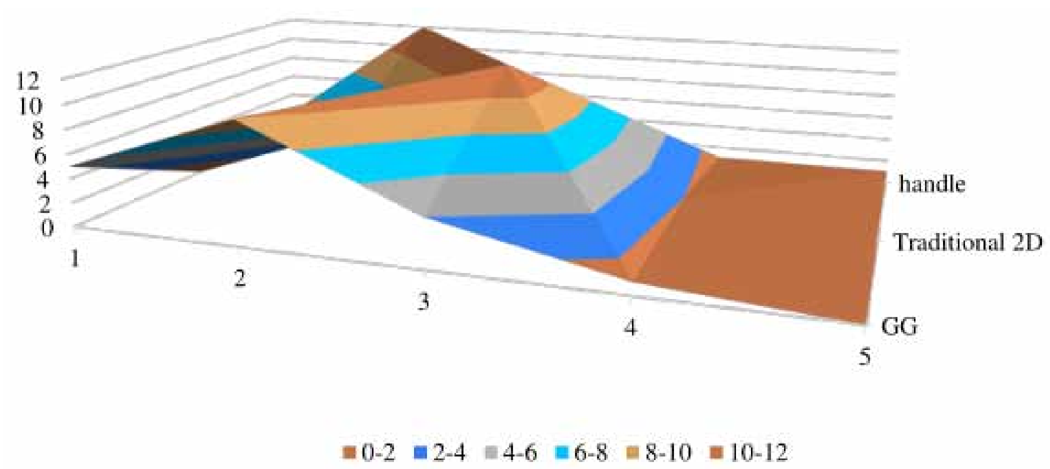


Figure 5. Schematic diagram of learning difficulty



Evaluation of Gaze Interaction Methods for Immersive Augmented Reality

Figure 7 compares the average time it takes users to complete tasks using different interaction methods, where the 2D interaction has the relationship with the time and objective locations, while the objective locations are close to the ending part of the controllers with the ball shape. The interactive time is smaller, and when the objective one far away from the initial position including the nose part, the time will become longer. By the comparison, the ways of position based on the user's watching and seeds of the gestures will be not affected by the factor.

Figure 6. User preferences

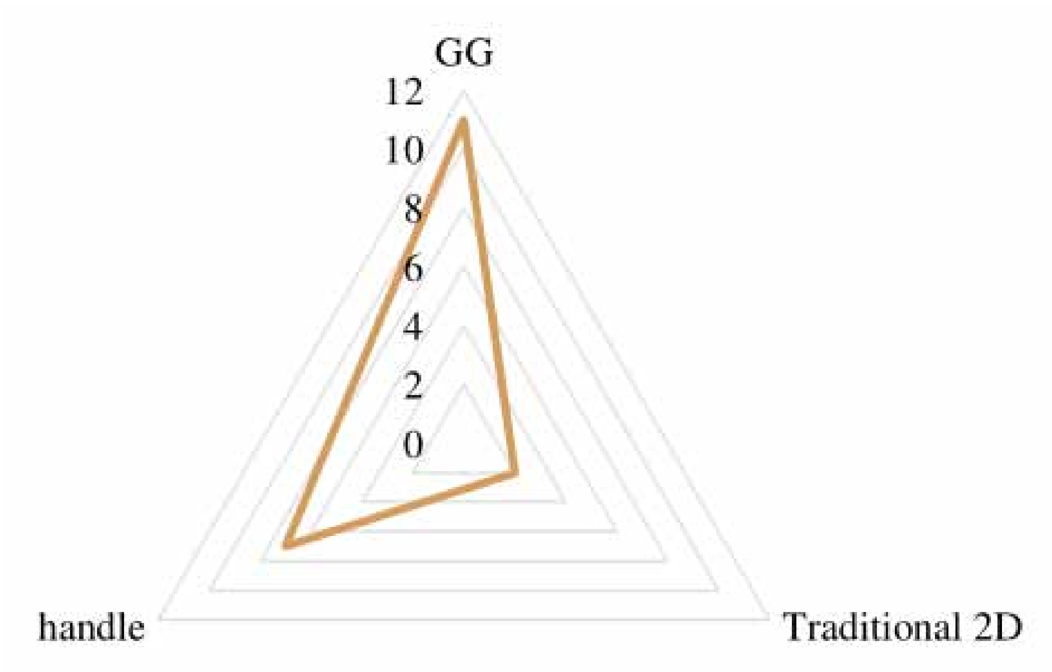
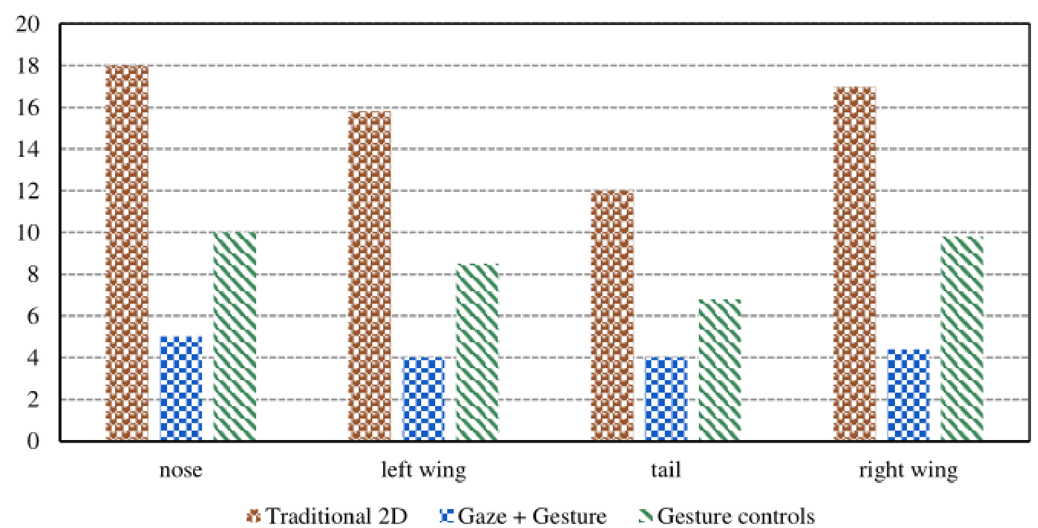


Figure 7. User interaction time



To sum up, to complete the layout and switching of streamlines naturally, and can reduce the fatigue caused by pure gesture interaction, but its accuracy is slightly inferior to the other two. Thus by introducing gaze interaction, it can effectively improve the fatigue problem caused by pure gesture interaction.

The traditional evaluation mode of this course is too singular; is seriously divorced from users, market, and society; and lacks a scientific evaluation system with clear objectives and standards. Therefore, researchers should reform the evaluation form of this course and introduce a result evaluation system that mainly focuses on user evaluation and that is supplemented by teacher evaluation. Teachers grade students' classroom performance, workload, and completeness of homework, accounting for 30% of the total score. The comprehensive results of simulation software and product usability test feedback as the results of user evaluation increased to 70%. This method has higher credibility and scientificity, which can not only help students recognize the shortcomings in the design process and accurately grasp the needs of users and the market, but also provide a reference basis for the evaluation system construction of other relevant courses.

CONCLUSION

As a core course of art design with strong practicality, the course of cultural and creative product design aims to cultivate professional innovative talents for modern cultural and creative industries. Based on the analysis of the characteristics and current situation of the course of cultural creative product design, this paper introduces virtual simulation technology into classroom teaching; guides students to use virtual simulation technology to develop, innovate and evaluate cultural creative products; It also discusses the specific reform and practice path of the course in the context of virtual simulation. The comprehensive result of simulation software and product usability test feedback as the result of user evaluation is increased to 70%. This method is highly reliable and scientific. It can not only help students to recognize the deficiencies in the design process and accurately grasp the needs of users and the market, but also provide a reference for the construction of the evaluation system of other related courses.

DATA AVAILABILITY

The figures used to support the findings of this study are included in the article.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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