The Practical Value of Virtual Reality Technology in the Practical Teaching Course of Art Design

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Abstract: Facing the demand of building a high-quality practice teaching system for art design majors in colleges and universities, and aiming at many shortcomings existing in the current practice teaching courses for art design majors, this paper will take advantage of the application advantages of VR technology, 3D modeling technology and visual interaction technology, take 3ds Max, Unity3D and other software programs as the core to design the simulation practice of art design, and adopt ASP.NET framework to integrate and package the system to form an art design practice teaching system. The system is presented by Web application, and the overall design is completed according to MVC mode. The development and deployment of each functional module will fully realize the virtual reproduction of the art design training process. This not only innovatively introduces the virtual simulation teaching method and online teaching form into the practical course of art design, but also strengthens the examination and evaluation of practical teaching. It is conducive to the cultivation of students' innovative spirit and practical ability, promotes the reform of teaching mode, and makes a positive attempt for the informatization construction of higher education.

1 INTRODUCTION

As an important force to promote social and economic development and lead the change of market environment, digital technology has not only promoted the transformation and upgrading of industrial structure in all sectors and fields of the whole society, but also made clear the new trend of future development. Innovative modes such as digital economy, multi-dimensional integration, and intelligent drive will accelerate the reshaping of the development pattern of the market and industry in an all-round way, and become an important way to achieve high-quality development goals in the new era and new stage. Under this background, the modes and ways of people's access to information are becoming more diversified and convenient, so that our cognition, thoughts and aesthetics have undergone tremendous changes. As the concrete embodiment of our ideology, art design has gradually realized the innovative development of networking and informatization, and has the characteristics of autonomy, timeliness, environmental protection and intelligence. At the same time, art design and economic development are closely related, and they interact and influence each other. The prosperity of art design needs economic development as the foundation, and economic development needs the empowerment and boost of art design. (Luo, 2019) The development trend of the art design industry will also be synchronized with the social and economic development, further integrating the concepts of science and technology innovation and application scenario expansion with interaction, service and sustainability, forming a comprehensive design concept and a brand-new design mode, and giving birth to the new demand for art design talents, and also setting a brand-new standard for talent training mode.

As an independent and comprehensive art discipline, the essence of art design is the comprehensive embodiment of personal thought, creativity and professional practice ability. Faced with the rapid changes in the market and industry, colleges and universities need to focus on solving the contradiction between the rapid development of art and design discipline and the insufficient effectiveness of education and teaching. Colleges

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and universities should fully realize the seriousness of the problems existing in the current education and teaching practice, such as single teaching means, unscientific training courses, disjointed teaching content and industrial application, and combine the current market demand and career development planning, reform and innovate the art design talent training mode, form a standardized art design education system, and improve the quality of talent training. (Chen, 2021) In view of this, this paper holds that colleges and universities should give full play to the positive role of information education means, create and improve digital teaching environment, aim at many shortcomings existing in current art design teaching, build an art design practice teaching system based on Web technology and VR technology as the core, and form a set of practical and comprehensive application solutions by virtue of the application advantages of virtual simulation teaching method and online teaching. The functional design of the system will fully meet the actual needs of students and teachers, which is not only conducive to the cultivation of students' innovative spirit and practical ability, but also can effectively reduce the difficulty of teachers' work, improve work efficiency, improve the teaching system of art design major and promote the reform of teaching mode.

2 OVERVIEW OF KEY TECHNOLOGIES

2.1 Virtual Reality Technology

VR (Virtual Reality), that is, virtual reality technology, is a modern technology that uses computer hardware devices and software applications to create a simulation environment, and integrates visual, auditory, tactile and other intuitive feelings into it, so that users can interact with various objects in the virtual environment in a natural way. (Yang, 2016) In the process of practical application, the application of virtual reality technology in the fields of modern education, military defense, industrial production, culture and entertainment, health care, urban construction, etc. has made great progress with its unique immersion, interactivity and multi-perception.

Virtual training system is the product of the integration of virtual reality technology and innovation in modern education. The virtual training system can be designed and developed according to the real course content or the actual application requirements, and the virtual reproduction of the training environment, conditions, processes and results can be completed with the help of input and output devices, servers and application software programs, so that users can get a similar real training experience to achieve the effect of replacing or partially replacing the real training. In addition, the virtual simulation training system also has application advantages such as saving time and cost, avoiding training risks, breaking through time and space constraints, which not only gives users a great space for autonomous learning, but also can effectively improve the training effect and realize the promotion of integrated teaching efficiency.

The construction process of virtual training system will go through many steps in turn, such as overall planning, data collection, material sorting, original modeling, scenario dummy, interactive development, test and release. The overall system architecture model is shown in Figure 1. The virtual training system can be divided into different categories according to the immersion degree and interaction mode. Compared with immersion and enhanced systems, desktop virtual training system only needs a generalized computer system to realize the normal operation of the system. Although it reduces the immersion of the system, it is convenient for students and teachers to operate, and has a wide range of popularization and application. The research core of this paper is the design and application of desktop virtual simulation training system in practice teaching of art design major.
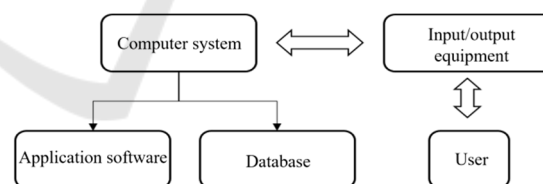

Figure 1: Architecture model of virtual simulation training system (original)

2.2 3D Modeling

3D digital modeling, also known as 3D modeling, is a digital technology based on the collection of points, lines, surfaces and other physical, chemical and other related information, that is, using computer systems and operating software to complete the reproduction of objects or scenes in a virtual 3D space. (Chen, 2022) 3D modeling technology is the key content design link in the VR industry. The quality and fineness of 3D models are directly related to the presentation effect of virtual

environment, and also determine the visual and experience effects of users.

The realization of 3D modeling is inseparable from the support of operating software tools. Different software tools have different advantages and different application scopes. Therefore, it is very important to choose an appropriate 3D modeling tool. Common 3D modeling tools include Rhinoceros, Solid Works, Maya and 3ds Max. Among them, 3ds Max software has powerful functions, can adapt to many application scenarios, supports a large number of extensible application plug-ins, has good operability, and is not difficult to learn at the beginning. It is the most widely used 3D modeling software at present. For the actual application requirements of this system, 3ds Max software will be selected to complete the construction of models and scenes. The process of 3D model building with 3ds Max software is shown in Figure 2. The main process will involve data collection of solid model, design and production of 3D model body, building of texture materials, material giving and baking, and model building and output.
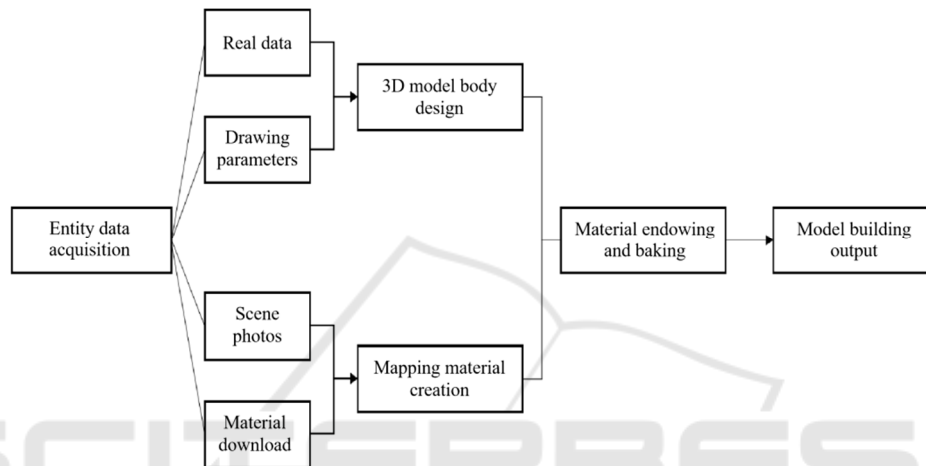

Figure 2: 3D model building process under MAX software (original)

2.3 Visual Interaction

Visual interaction belongs to the technical category of human-computer interaction, aiming at realizing the way that users can access information or interact with information by using graphics and images as transmission media. Compared with the traditional man-machine interaction mode, visual interaction optimizes the display mode of information, facilitates users to intuitively and efficiently obtain real-time dynamic data information in a more natural way, and improves the effectiveness of man-machine interaction. In the virtual reality environment, deep immersion sensory feeling and natural and comfortable human-computer interaction are the mainstream research directions of future virtual reality application systems. (Xu, 2021)

In the interactive design stage, this paper will choose Unity3D software as the development engine. Through the built-in functional components such as collision detection, material setting, particle dynamic effect and interactive mode, users can quickly unify the human body movements and the data operation and processing capabilities of the system, and realize the real-time interaction between man and machine. In addition, Unity3D supports a variety of output formats, which is convenient for virtual reality systems to run on different equipment terminals. Among them, WebGL format can support the display of virtual reality scenes and models in web pages. It only needs to input the website address without installing any functional plug-ins, which is more suitable for the application of desktop virtual simulation training system of art design in this study.

2.4 Development Process

According to the application requirements of the above related application technologies, we can complete the configuration and deployment of the development environment of art design practice teaching system. The development content of the system is divided into two parts. One is to complete the design, construction and project export of virtual training function modules based on 3ds Max, Unity 3D and other software. The second is to complete the integration and encapsulation of the system in

ASP.NET environment, form a standard Web application, and publish it on the server.

For the design of virtual training function module of art design, based on the specific project cases in the fields of visual communication, environmental arts, plane and product design involved in art design, and based on the physical data of all kinds of tools, materials and finished products, the corresponding model is made in 3ds Max software. After the modeling is completed, materials will be given and maps baked, which will make the model more realistic and vivid. The establishment and production of map materials need to be handled by Photoshop software. After all kinds of models are designed and built, 3ds Max software exports all 3D models to. FBX files, and introduces these files into Unity 3D. In the Unity 3D software, the integration and assembly of models and scenes, the addition and optimization of dynamic effects, the setting and processing of objects in the environment and the development of key interactive functions will be completed.

In the process of scene building, there are mainly terrain creation, lighting and shadow processing, sky box setting, atomization effect adding and other steps. Terrain creation mainly depends on the Creat Terrain command of Unity3D software, and then the details are edited, including improving the surface mapping and adding plant models. For interactive function design, a lot of functional script codes need to be written. For example, the user can rotate the model through mouse control. The specific implementation code is shown in Figure 3. After all the designs are completed, use Unity 3D to publish all the 3D data to the Web, that is, choose Unity3D to choose WebGL for export. After the project is exported, all content-specific files containing WebGL are generated.

The overall development of the system is based on Windows10.0 operating system. The basic development environment is. net framework 4.7.1 in ASP.NET, the development language is C#, and the integrated development tool is Visual Studio Code. The Web server is Windows IIS 10.0, and the database is SQL Server 2019. After the system is fully developed, it will be packaged and published to the IIS server. After the corresponding ports are configured, users can use the system from the client browser. Through the introduction of the above key technical theories, we have determined the overall environment of the system development, the running process of related software and tools, and the technical feasibility of the overall project of the art design training teaching system.

```
public class TransformModel : MonoBehaviour
{    public int yMinLimit = -20;
     public int yMaxLimit = 80;
     public float xSpeed = 250.0f;
     public float ySpeed = 120.0f;
     private float x = 0.0f;
     private float y = 0.0f;
     void Update()
     { if (Input.GetMouseButton(1))
          {   x += Input.GetAxis("Mouse X") * xSpeed * 0.02f;
              y -= Input.GetAxis("Mouse Y") * ySpeed * 0.02f;
              y = ClampAngle(y, yMinLimit, yMaxLimit);
              Quaternion rotation = Quaternion.Euler(y, x, 0);
              transform.rotation = rotation; }
          }
}
```

Figure 3: Key code for optional mouse control model (original)

3 DETAILED FUNCTION IMPLEMENTATION

3.1 Student Side

After the user passes the account password verification and authentication, the system will automatically jump to the home page interface. Under this page, there are two functional modules: simulation training and training assessment. Under the simulation training module, students and users can intuitively obtain the content of training programs and practice teaching units of special skills in different professional directions. The curriculum design is shown in Table 1. Students can choose and enter the study independently. Before the virtual simulation training, the system can provide corresponding video learning materials, which is convenient for students to quickly master the training operation process and master the application methods of the virtual simulation training system.

Table 1: Design of some training contents

Major field	Training content	Target
Visual communication design	Font design, logo design	Master professional skills and methods to improve practical ability.
Environmental art design	Interior design, landscape design	Master the expression methods of environmental art design and improve aesthetics.
Product design	Clothing design, household product design	Master product design process, and have knowledge of ergonomics and aesthetics.
Graphic design	Advertising design, packaging design	Deepen the understanding of graphic design and improve the ability of design and production.

After students finish their studies, they can complete the corresponding project training. The system supports two training modes, one is cognitive training and the other is functional training. Among them, cognitive training is mainly to improve students' level of learning and mastering some concepts, materials and structures. For example, in the clothing design project, cognitive training will realize the "instant change" of fabrics through different model transformations, visually compare the clothing appearances of different types of fabrics, deepen the understanding of the characteristics of all kinds of fabrics, make students clear the principles of clothing material selection, and improve the rationality of clothing fabric design.

(Wang, 2022) Functional training can fully simulate the whole process of actual work or production, improve students' proficiency in professional skills and exercise their comprehensive ability. For example, clothing design projects, the system will support users to complete various operations such as body shape matching, clothing modeling planning, fabric attribute selection, pattern process design. During the training process, students can control the switching of perspectives through the keyboard, which is convenient to view and control details from multiple angles. This function depends on the script code control of Button View Change class under Unity3D. The key code is shown in Figure 4.

```
public class CameraMove : MonoBehaviour
{    public float sensitivityMouse = 2f;
     public float sensivetyKeyBoard = 0.1f;
     public float sensivetyMouseWheel = 10f;
     void Update()
     {   if (Input.GetAxis("Mouse ScrollWheel") != 0)
         { this.camera.fieldOfView = this.camera.fieldOfView - Input.GetAxis("Mouse
ScrollWheel") * sensivetyMouseWheel;    }
         if (Input.GetMouseButton(1))
         {   transform.Rotate(-Input.GetAxis("Mouse Y") * sensivityMouse,
Input.GetAxis("Mouse X") * sensivityMouse, 0); }
         if (Input.GetAxis("Horizontal") != 0)
         {   transform.Translate(Input.GetAxis("Horizontal") * sensivetyKeyBoard, 0, 0); }
         if (Input.GetAxis("Vertical") != 0)
         {   transform.Translate(0, Input.GetAxis("Vertical") * sensivetyKeyBoard, 0); }
```

Figure 4: Key code for first-person perspective and third-person perspective switching

Under the training assessment function, student users can complete the training assessment. The assessment content is related to the training project, and the topic will be composed of multiple control operation commands, each of which corresponds to a different score, and the system will score it according to the accuracy of the operation commands.

3.2 Teacher Side

Compared with the functional design of students, teachers pay more attention to the design, maintenance and assistance of practical teaching courses. When teachers log in to the system, the main work lies in the uploading and publishing of training course information and some teaching resources, as well as the organization and implementation of training teaching. In addition, the teachers will give subjective scores according to the final training results, and the teachers' scores will be

graded according to five grades: excellent, good, fair, poor and very poor, with five weights of 10, 8, 5, 3 and 1 respectively. After the evaluation, the system will automatically construct the evaluation model matrix, combine all teachers' scores with the system's automatic scores, and introduce confidence G to complete the final score evaluation. For example, Formula 1 is the evaluation matrix, where C represents the teacher's evaluation score, r_i represents the degree scores of different assessment points, and the final calculation formula of students' comprehensive evaluation value is shown in Formula 2, Q represents the system's automatic score, and M is the final score.

$$C1 = \begin{bmatrix} r_{11} & r_{12} & r_{13} \\ r_{21} & r_{22} & r_{23} \\ r_{31} & r_{32} & r_{33} \end{bmatrix} \tag{1}$$

$$M = Q_i + \sum_{i=1}^{n} G_i \times C_i \tag{2}$$

4 CONCLUSIONS

Based on the actual needs of the reform of modern education teaching mode in colleges and universities, this paper puts forward a comprehensive application solution that combines online teaching and virtual simulation experiment teaching methods in view of the difficulties faced by the current art design practice teaching process. The construction and application of the system will fully realize the virtual reproduction of the art design training process, which is conducive to the cultivation of students' innovative spirit and practical ability, promotes the improvement of the art teaching system, and makes outstanding contributions to promoting the informatization construction of higher education.

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