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Virtual Reality Technology in Art Education System

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Abstract. Our country has always attached great importance to the cultivation of talents and the development of education. As education has now entered the information age, there have emerged more new concepts, new demands and new challenges, which require us to constantly absorb new technology to improve and optimize the education system. After studying the current application of virtual reality technology and the shortcomings of the education system, this paper tries to take the Industrial design Department of China Academy of Art as a sample to explore the new way of applying virtual reality technology in the field of art teaching. Through the combination of vision and software, we try to create a new digital system for the Industrial design department, build a personalized creation virtual space for students, and provide functions such as virtual tour, online class, virtual exhibition, space construction and alumni exchange. This research has certain social significance. It combines technology with art education and helps to enhance the efficiency of education.

Keywords. Virtual reality, art education, immersive, creativity

1. Introduction

In the rapid development of digital technology, virtual reality technology has become a hotspot for people's attention, it is a new technology of multidisciplinary cross-fertilization emerging in the field of information technology, the use of computer technology to create a digital three-dimensional spatial scene, and the experience of the person who feels the changes in the virtual world through their own senses [1]. It now permeates every aspect of our lives, bringing radical changes to our production and lives. Virtual reality technology has been involved in many fields, such as military, medical, education, culture and tourism, etc., it is through the emphasis on the experience of the user's own senses, to enhance the user's visual, tactile, auditory and other experiences, to bring the user immersive experience, so as to enhance the quality and efficiency of people's work. And for the past decade, higher education institutions have also undergone profound transformation and are facing new technological challenges in the educational arena [2]. After studying the current application of virtual reality technology and the shortcomings of the education system, this paper tries to take the Industrial design Department of China Academy of Art as a sample to explore the new way of applying virtual reality technology in the field of art teaching.

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This thesis will use blender, c4d and unity 3d as the development software, oculus quest 2 hardware device as the carrier, and take the industrial design building of China Academy of Art as an example, to explore the new way of applying virtual reality technology in the field of art education. Through the combination of visual and software, we try to build a digital twin display system for the industrial design department of China Academy of Art, to build a personalized virtual space for students' individual creation, to strengthen the relationship between teachers and students through a new form of interaction, and to stimulate students' creativity through the construction of a virtual campus and a personal virtual space. The construction of the whole teaching display system relies on the idea of alumni association recently put forward by China Academy of Art, and in terms of visual presentation, it shows the overall appearance of China Academy of Art, which enhances the cohesion of the students and at the same time serves to promote the campus. The whole system mainly focuses on the emotional bond between teachers and students as well as the exhibition creation needs of design students, so it is not limited to the industrial design area of the China Academy of Art, but can be extended to all creative groups with group attributes, and through the incorporation of virtual reality technology, it helps people to have a more immersive touring experience and a more efficient creative workflow.

In summary, exploring the application of virtual reality technology to art education in order to construct a teaching display system will be conducive to the image promotion of the campus, strengthen the emotional attributes of the alumni group, and enhance the creative enthusiasm of industrial design students. At the same time, it is also significant for helping groups with creative needs and exploring new ways of applying innovative education.

2. Analysis of virtual reality technology

Virtual reality technology consists of several systems, including the virtual environment system, the processing system of the computer used, display equipment, etc. [3]. The implementation method primarily involves using computer programming as a foundation, combined with three-dimensional graphics and multimedia display technologies to create an immersive space, providing users with a lifelike three-dimensional experience, and even simulating various senses such as touch and smell. It is a product of the cross-application of a variety of disciplines and technologies, along with the development of various disciplines and high technology, virtual reality technology has also been a great development, and gradually be used in all aspects of our lives.

2.1. Technical overview

VR systems require harmonious coordination among interaction, locomotion, audio, visual, and task design, to provide users with a good immersive experience [4]. Virtual reality technology has the following main qualities:

- Immersion

  Immersion refers that virtual reality technology is the combination of computer systems and three-dimensional graphics or multimedia, which can allow users to feel that they are parts of the virtual space [5]. Virtual reality environment

refers to the virtual environment built in the computer, through the visual, auditory, tactile, and other senses to achieve a variety of real-time means of interaction, you can realize the establishment of the virtual environment [6]. People are able to move and interact in the virtual space, experience touch and taste, smell and vision, just as in the real world. This is also the biggest feature of the virtual scene: Simulation, to achieve the restoration of the real environment [7] .

- Interactivity

  Interactivity refers to the fact that the users can interact with objects in the virtual environment to a certain extent in the virtual space, including but not limited to simple gravity and physical collisions. Through the setting of program triggers, it is possible for the users to get close to or touch a certain object in the virtual world, and make a certain behavior to trigger the corresponding interaction and get the corresponding feedback. For example, the virtual space scene, the transformation of objects, the flashing and disappearing of dialogue pop-ups, and so on.

- Multi-sensory

  Multi-sensory refers to the ability of computer technology to support multiple human sensory modalities, such as hearing, touch, smell, and vision. The final form of virtual reality technology should be able to replicate all human perceptual functions, and provide a sense of immersion that is exactly the same as or even greater than that in the real world. However, due to the lack of technological development, especially the limitation of the current sensing technology, most of the current virtual reality technology are still limited to the senses of sight, sound and touch. Among them, vision and hearing are the core perception modules of current virtual reality technology.

- Conceivability

  Conceptualization is one of the main points of distinction between virtual reality and reality. In the world of virtual reality, there can be experiences such as fully realistic gravity systems and visual effects, but it is also possible to create and realize environments that cannot exist in reality according to the human's own imagination, such as levitating buildings, glowing trees and other things that do not exist in reality.

- Autonomy

  It is the extent to which objects in the virtual world act according to the laws of physics. For example, whether the objects follow the real-world gravity system, and whether rigid or flexible objects interact with each other in terms of force when they collide and undergo corresponding deformation and positional shifts.

2.2. Application status

Virtual reality technology has now been applied in the field of education. Compared to traditional offline education, through virtual reality technology, colleges can give students a more immersive teaching experience, such as learning to appreciate the "Thousand Miles of Rivers and Mountains", when the mainstream education is still

through the graphic and the teachers' words to help students to understand what it means, with the addition of virtual reality technology, the teacher can take the students go back to the thousands of years ago in the midst of the verdant landscapes and feel the beauty of the mountains and forests. Virtual reality technology can also realize low-cost and low-risk experiments, remote and efficient online courses and other useful functions. For example, the Geological Crystallography Learning System developed by China University of Geosciences realizes the structural characteristics of crystals through virtual reality technology so that students can recognize and learn more clearly [8].

Virtual reality technology has already been used in the design field as well. Through virtual reality technology, people can experience the results of design in an immersive way and understand the designer's intention, for example, they can travel to roam around in a building whose design has been completed but has not yet been built, and experience new products that have not yet been released. At the same time, virtual reality technology can also be applied to the designer's workflow to improve the designer's design quality and work efficiency. With the development of digital painting and design, art stylization technology, as the core of digital brush engine, is widely used in creative tool software [9]. For example, designer H.Y. Kan's team built an Internet-based virtual reality collaborative environment, Virtual Reality Based Collaborative Environment (VRCE), a working model that successfully makes collaborative design feasible for small and medium-sized enterprises with a narrow range of low-cost products [10]. VR is also used to develop and inspire communication, collaboration and other soft skillsets that are at the core of pedagogy and learning [11]. The study showed that by learning in a virtual reality environment, the testers achieved good learning outcomes in emotional adaptation skills [12], safety skills in a variety of hazardous situations [13], social skills [14], etc.

Virtual reality technology now has a more stable development mode and smooth output effect, and has been used in different areas of life, it also achieved good results. Meanwhile, with the continuous development of computer, multimedia and other fields, virtual reality technology also continues to develop at a high speed, with a very broad prospect. It is foreseeable that virtual reality technology will be highly involved in our production and lives in the future. However, while virtual reality technology plays a big role, the technology itself also has some non-negligible problems.

Some users may get dizziness, vomiting and other uncomfortable feelings when using VR equipment. Sufficient refresh rates of displays and updates in the virtual world are key factors to consider when using VR, as the user will be otherwise likely prone to motion sickness on longer exposure [15]. The perfect experience of virtual reality technology depends on the appropriate VR equipment, and the current price of VR equipment is generally expensive, common VR glasses are generally located in the price of more than three thousand, and the one VR equipment at the same time can only be used for one user to experience. The current virtual reality presents in the development also need to cooperate with the equipment model adaptation, different unsupported models in the development and the use of the process will often frequently report errors and other problems, which also enhances the development of the cost and difficulty. Reducing the price of equipment, lowering the difficulty and threshold of development, and improving the quality of the output with creative content may be the direction and goal of the development of virtual reality technology. With the progress of virtual reality technology, in the future, the virtual environment will become more realistic and better meet people's requirements for the use of virtual space [16].

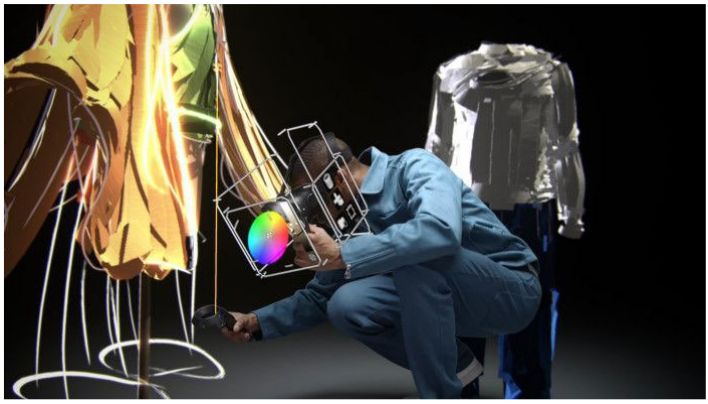

Figure 1. Tilt Brush, which allows professional artists or hobbyists to realize painting in VR space

3. Integration of virtual reality technology and campus

Currently, VR and AR are setting trends with great impact on various studies and proposals applied to the field of education and its creative process [17] After analyzing the existing cases of virtual reality technology, it can be determined that the application of virtual reality technology in the education system can well enhance the students' learning efficiency and enthusiasm and optimize the college teaching experience. In the following, the industrial design department of China Academy of Art is taken as a case study, and the research and system design are attempted.

3.1. Basic campus information and user research

The Industrial Design Program of China Academy of Art was first established in 1993, and has a long history of thirty years so far. The department takes social needs, humanistic responsibility and post-industrial as the directions of discipline construction, takes new materials, new processes, new theories, new industries, new fields and new issues as the characteristics of professional research, and spans the three disciplines of arts, science and engineering to cultivate design and research talents in the fields related to industrial design and product design.

Rooted in the core concept of oriental design, based on the international vision and the forefront of the times, China Academy of Art's industrial design program adheres to the "user-centered" scientific law of art and design, takes the beauty of the local lifestyle as the source, cross-border synergy as the way, cultural creativity as the driving force, scientific and technological integration as the means, and industrial transformation and service as the key to revitalize traditional Chinese culture and to promote the development of the industry. With the revitalization of traditional Chinese culture and the equal emphasis on design creation and intellectual manufacturing, we will create a localized systematic innovation model for China's industrial design profession, establish professional characteristics combining traditional innovation and technological integration, and strive to build a new image of China's design in the era of globalization.

Through questionnaires and offline interviews, we have a certain preliminary understanding of the current industrial design education in China Academy of Art. A

total of 46 questionnaires were collected, of which 44 were valid questionnaires, all of them were students studying in the Department of Industrial Design, and the grade ratio of freshman: sophomore: junior: senior was 5:3:1:1. The number of offline interviews was four, one for each grade. After summing up, we try to find out the existing shortcomings and strengths and explore feasible optimization solutions.

Table 1. What is the best way to document creativity in the learning process

Option	Quorum	Proportion
handwritten records	30	68.18%
electronic record	32	72.73%
mental note	16	36.36%
non-record	5	11.36%
others	0	0

Table 2. What are the limitations of current methods of acquiring knowledge

Option	Quorum	Proportion
similarity	31	70.45%
traceability is difficult	18	40.91%
hysteresis	16	36.36%
high landing threshold	9	20.45%
single presentation	13	29.55%
difficulty in searching	19	43.18%
others	2	4.55%

3.2. Current problems

- Teaching display form is relatively single: now the teaching method of industrial design colleges is still based on offline teaching, supplemented by a certain amount of e-learning, and e-learning is still limited to catechism, screen equipment, data statistics and other fields, which can't enhance the teaching efficiency and enthusiasm for learning.
- Teaching display limited by time and space: in the teaching of industrial design will often open physical exhibitions to explain, offline lectures and other activities limited by time and space, once the students miss, it is difficult to have the opportunity to observe and experience, the existing system cannot cross the time and space to solve this problem.
- The advantages of the alumni group are not well utilized: design is a job that requires more exchanges of ideas and more collisions of thoughts in order to come up with better ideas. In the previous research, we have found that the teachers and students of China Academy of Art have a strong willingness to share, they are willing to share their ideas with their classmates, which is a good platform in itself, but the existing system does not give good play to the advantages of the alumni group, to strengthen the exchange of teachers and students to view the exhibition and learning.

3.3. Prospects and trends of virtual reality technology used in art education

In order to cope with the new needs of art talent training, art professional education and exhibitions also need to move closer to digitalization and diversification, and the means also need to be updated. Virtual reality technology supports the systematization of the whole process of "from design to manufacturing" and "from production to marketing" simulation through the construction of a high-fidelity simulation environment. Through virtual reality, industry practice can be introduced into the learning process, guiding students' interest in learning, stimulating students' creative potential and enthusiasm for learning, helping students' sustainable innovation, increasing the possibility of improving the real world through design creativity, and helping students to continue to develop after graduation and in the longer term. By adding virtual reality technology, the college can realize immersive experience and novel interactive forms in the process of creation and teaching exhibitions, which enhances students' learning efficiency and enthusiasm for learning. Meanwhile, the digital twin world constructed by virtual reality technology can meet people's needs of visiting different times and spaces, which is a good solution to the problem of art education being limited by time and space. The addition of virtual reality technology also provides a good platform for communication between student groups, and the combination of virtual reality technology and art design education system is a feasible direction for the future. Virtual reality technology can be a good solution to the problems that occur in the art campus at this stage.

4. An attempt at intelligent art education starting with virtual reality technology

The use of virtual reality technology in the art education system not only meets the creative needs and emotional social attributes of the user group, but also solves the constraints of time and space, and improves the effectiveness of work and enthusiasm for learning. The virtual environmental characteristics such as active presentation of materials, unlimited access level to the learning materials, and presentation of the materials in a supplemental format were more effective [18]. This paper takes the Department of Industrial Design of China Academy of Art as a case study, but the idea is also applicable and can be extended to all user groups with creative needs, and has certain social value. The Fig. 2 shows the specific functions and structural framework.

4.1. Specific functions of the virtual art education creation system

- Virtual Tour: Take a virtual digital human tour of the Industrial Design Building, where experiencers can see and experience different industrial design products across time and space.
- Online Seminars: Participate in online seminars or online courses as a virtual participant, with no space limitations and permanent record keeping.
- Exchange of insights: works in the virtual space can be commented on and exchanged with the creators to produce a collision of ideas across time and space to inspire.

- Personal Creation Exhibition: You can exhibit your own works in your personal space to form your own pavilion, and you can also invite others to visit and exchange ideas.
- College business card: to make the college more cohesive, the unity of visual style will become a business card of the college and play a certain role in publicity.

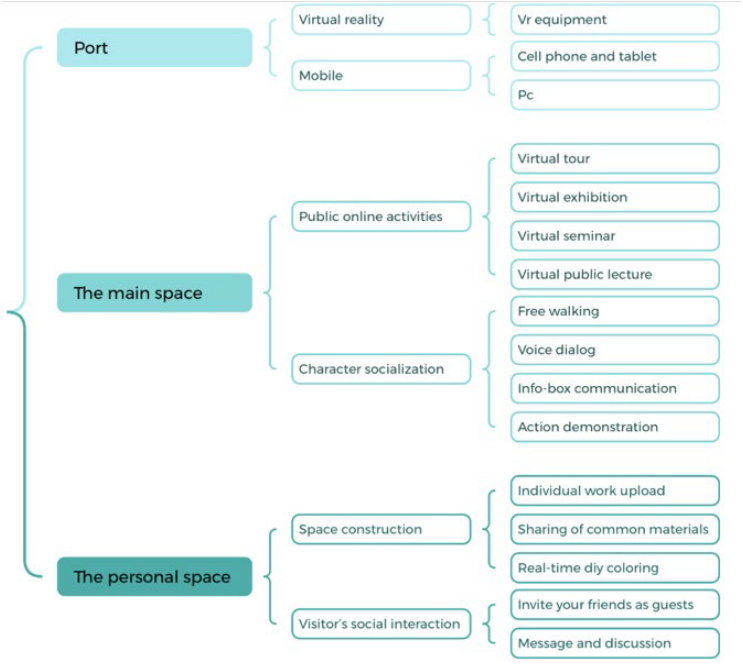

Figure 2. Illustration of the virtual art education creation system.

4.2. Initial effect projection

In order to realize the envisioned framework function, the construction of the scene chooses to be carried out in sketch up, blender and c4d first, after the scene design and intention map output, it will be transferred to the modeling software for the production of the model, and then imported into unity 3D for the rendering of the material and the atmosphere of the scene, and then after the visual effect meets the requirements, it will produce the physical collision effect through the collider plug-in that comes with unity. After the visual effect meets the requirements, the physical collision effect is made by the collider plug-in of unity, to realize the anamorphic walking experience and spatial atmosphere, and the trigger event trigger and trigger box are set to the object, to combine the interactive UI with the object space, to realize the free interaction of the virtual reality.

Figure 3. Main space effect display

Figure 4. Personal space effect display

Since the early days of VR, various locomotion techniques have been developed and studied, targeting seamless and user-friendly navigation in virtual environments [19]. Considering that users need to participate in the virtual roaming, the user's access threshold and interaction guidance are designed and optimized. After combining the use of programming scripts and unity trigger triggers, we added an air wall and delineated a certain trigger area and bound the trigger event, when the user enters the trigger area, there will be specific interactions to guide the user: when walking into the corresponding area, the corresponding cursor will appear under the feet to guide the path, and when leaving, the cursor will disappear, and the cursor will guide the path of the tour; when entering the specific area, the interactive objects will appear light effects to remind; when the object is selected, the object will appear a special light effect state. When you enter a specific area, the interactable objects will appear with light effects to remind you; when an object is selected, the object will appear with a special light effect state.

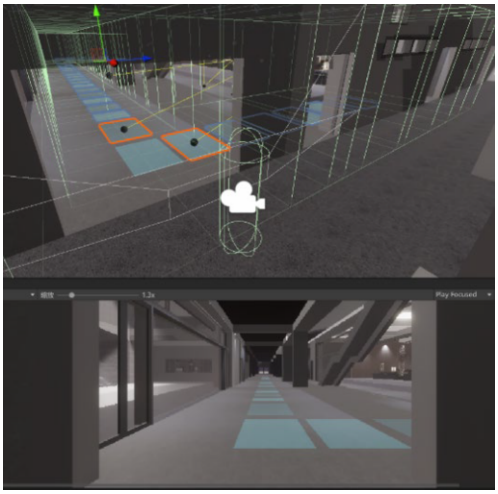

Figure 5. Pathfinder display

4.3. Summery

This chapter is an optimized design of the problems existing in the current education teaching exhibitions found in the above research results, trying to solve the deficiencies of the current teaching as well as the creative display system through the application of virtual reality technology, and realizing the integration of arts and sciences. Through learning in the virtual reality environment, students can experience the teaching process in a more immersive way, communicate their ideas more efficiently, realize the collision of thinking across time and space, and enhance the teaching efficiency while reducing the cost of practice.

The system design of applying virtual reality technology to art education is a feasible solution for the application of virtual reality technology to art education by combining the technical characteristics of virtual reality technology and the characteristics of teaching.

5. Conclusion

This paper explores the optimization of the existing art education system through virtual reality technology. In the design, taking the industrial design department of China Academy of Art as an example, the virtual teaching building and exclusive creation space for students of the National Academy of Art are built to enhance the sense of belonging and creative inspiration of the students of the Academy, and optimize the creative efficacy and experience.

Taking the comprehensive construction class as an example, the teacher can present the internal functional structure of the product to the students through the virtual environment, and the students can also carry out mechanical experiments through the virtual interaction, and even take a cloud tour of the machinery manufacturing workshop to understand the construction process. In this virtual reality technology architecture of the creation system, students can more immersive experience of the creative content, across the time and space for efficient learning and communication, more diverse

interaction and interaction. The construction of the virtual teaching building makes it possible to visit and learn without regard to space and time, while the composition of personal space completely unleashes the creativity and imagination of the students. Depending on the alumni as a whole, through virtual reality technology, we can develop and tap into the huge social function and design power that has not been utilized so far, to inspire members and enhance the efficiency of work.

Virtual reality technology is rapidly changing and developing, and has been combined and utilized in every aspect of our lives. At a time when emphasis is placed on nurturing people and cultivating talent, the integration of virtual reality technology and artistic creation is an irreversible trend, and the addition of virtual reality technology will undoubtedly bring optimization and quality improvement to our creative methods. This is a process of fusion of art and technology, the successful operation of the system still needs careful design and debugging, and more unremitting efforts, but it must have corresponding social value and significance.

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