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Digital Inheritance and Innovation of Art and Culture Based on VR Technology

Zhongxuan Tan[1,2,a,*]

[1]*University of Perpetual Help System DALTA, Las Pinas City, 1740, Philippines*
[2]*Guilin University of Aerospace Technology, Guilin, Guangxi, China*
[a]*tttzxyue@163.com*
[*]*Corresponding author*

Abstract: *With the continuous development of technology, VR (Virtual Reality) technology has been widely applied in the field of art and culture. This article mainly discusses the digital inheritance and innovation of art and culture based on VR technology. The application of VR technology in the field of culture and art has become increasingly widespread, demonstrating strong potential and prospects in art display, cultural relic protection, performance, and other aspects. At the same time, utilizing VR technology for digital inheritance of culture and art not only allows for better preservation and inheritance of traditional culture, but also enables multi angle and comprehensive display and presentation through technical means such as virtual simulation. This can enhance the audience's sense of experience and participation, thereby promoting the protection and inheritance of culture and art. In addition, VR technology can also bring more forms of expression and innovative space for culture and art. For example, using VR technology for artistic creation can combine traditional art forms with digital technology, opening up innovative forms of artistic expression and innovative space; VR technology can also be used in various aspects such as art sales and performances, bringing broader market and commercial value to culture and art. At the same time, it can also meet the needs of audiences and enhance participation and immersion. Therefore, the digital inheritance and innovation of art and culture based on VR technology has very important significance and broad prospects.*

Keywords: *Art and Culture, VR Technology, Digital Inheritance, Innovative Development, Neural Networks*

1. Introduction

With the continuous development and progress of technology, VR technology has gradually been widely applied in various fields, including the field of art and culture. VR technology not only enables the digital inheritance of artworks, allowing them to be continued and preserved, but also provides people with a more immersive artistic experience, giving them the opportunity to experience art and culture that cannot be experienced firsthand in the real world in a virtual world. Digital inheritance is the process of preserving and disseminating traditional culture, artistic elements, and other elements through digital technology. It not only prevents the loss of traditional culture, but also transforms it into digital resources, allowing more people to understand, learn, and inherit. In the field of art and culture, digital inheritance can also digitize the preservation of artworks, avoiding the damage and loss of physical resources, and spreading these digital resources to more people for understanding and appreciation. In addition, VR technology can also provide people with a more immersive artistic experience. In the traditional art exhibition, the audience can only understand the artwork by watching the pictures or words. With the support of VR technology, the audience can enter the scene represented by the artwork to better appreciate and feel the charm of the artwork.

The arrival of the big data era has had a huge impact on the development of various industries in society. There are abundant art and cultural resources in the world, but their search is difficult and inefficient. Therefore, the rational development and utilization of artistic and cultural resources is to provide high-quality artistic and cultural products. In the context of big data, Xuewen Xia proposed a rhododendron search algorithm based on change factors. Through data analysis and Matlab software experiments, the results show that the overall convergence speed of the azalea search algorithm based on change factors is significantly better than the azalea search algorithm [1]. The purpose of Pudov A.

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G is to classify Yakut art culture (from pre modern to postmodern) and to classify the inherent consciousness symbol structure of these stages of art in a typological manner [2]. Christian culture, with its spiritual and moral connotation and rich artistic experience in controlling the world, is the source of rich aesthetic appreciation for modern youth. The art of personality and the main means of aesthetic education are considered art, and the origin of art is stored in cultural, artistic, and religious traditions, which develop with the development of civilization. From the 20th century to the turn of the 21st century, the crisis phenomenon in social spiritual life led to a general decline in the cultural level of learners and educators, who did not always have time to fill the gaps in the spiritual components of education and growth. The purpose of Balakhnina L. V. is to systematize the regional experience of the formation of Eastern Orthodox religious culture as the foundation for art and aesthetic education for the younger generation in the early 21st century [3]. However, these scholars have not integrated VR technology with the digital inheritance of art and culture.

The application of VR technology in the field of culture and art has become increasingly widespread, and the digital inheritance and innovation of art and culture based on VR technology has very important significance and broad prospects. This article analyzes the application of VR technology in culture and art, and explores the advantages of VR technology in the digital inheritance of culture and art. The use of VR technology for creation, display, sales, etc. can bring more innovation space and commercial value to culture and art, further promoting the development and prosperity of culture and art.

2. Digital Inheritance Method of Art and Culture Based on VR Technology

2.1 Application of VR Technology in Art and Culture

(1) Digital Museum

A digital museum is a virtual museum established using VR technology, which can simulate the scene of a real museum and display a rich and diverse range of cultural relics and historical sites. Simulated scenes can provide users with an immersive experience, and rich and colorful historical materials can also help users better understand the historical background and cultural connotations of cultural heritage [4-5].

For example, the Palace Museum has launched the "Digital Exhibition of the Palace Museum" project, which uses VR technology to reconstruct some of the exhibition halls of the Palace Museum, allowing people who cannot reach the Palace Museum to personally experience the visual feast brought by advanced technology.

(2) Art creation

VR technology can also be used for artistic creation. Through VR technology, artists can conduct experiments and create in virtual spaces, resulting in more creative and innovative works [6-7]. For example, the exhibition "Carnival of Rome" adopts VR technology, allowing viewers to experience the liveliness and atmosphere of ancient Roman carnivals.

In addition, VR technology can also digitize traditional art forms, injecting new impetus into the inheritance and development of art [8-9]. For example, in the "Traditional Craft Digital Experience Hall" project carried out by the Beijing Cultural Heritage Protection Center, by digitizing the traditional craft production process, audiences can experience the traditional craft production process firsthand in a virtual environment, enhancing people's understanding and inheritance of traditional culture [10-11].

2.2 Neural Network Algorithm Based on VR Technology

VR technology is a technology that utilizes computers to generate images and simulate interactions, allowing users to experience virtual scenes firsthand. The neural network algorithm is a machine learning algorithm based on artificial neural networks, which extracts features from data through learning, enabling autonomous classification, recognition, and generation tasks.

In the digital inheritance and innovation of art and culture based on VR technology, the use of neural network algorithms for feature extraction and processing of cultural relics can better achieve digital preservation and display of cultural relics; Similarly, VR technology can also provide a more realistic environment and data for neural networks, thereby improving the performance and accuracy of neural network algorithms.

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Taking the digital inheritance of cultural relics as an example, by utilizing VR technology and neural network algorithms, three-dimensional modeling of cultural relics can be carried out, and feature information such as shape, material, and texture can be extracted. Then, these feature information are input into the neural network for training, in order to achieve automatic classification and recognition of cultural relics, and can be used for 3D (Three dimensional) simulation and VR virtual display of cultural relics. In addition, neural network algorithms can also be used to analyze and interpret the history, cultural connotation, and value of cultural relics, in order to better inherit and promote human culture.

(1) Neuron activation function ReLU (Rectified Linear Unit):

$$f(x) = \begin{cases} x, if\ x \geq 0 \\ 0, otherwise \end{cases} \tag{1}$$

x represents the input of the neuron, and $f(x)$ represents the output of the neuron. ReLU activation function is mainly used to solve the gradient disappearance problem in the neural network, which can make the neural network more efficient in model training, and can effectively extract the feature information of cultural relics. In the digital inheritance and innovation of art and culture based on VR technology, ReLU activation function can be used to optimize the neural network model to achieve the feature extraction and classification of cultural relics and other functions [12-13].

(2) Recurrent Neural Network LSTM (Long Short Term Memory)

$$\begin{gathered} i_t = \sigma(W_{ii}X_t + b_{ii} + W_{hi}h_{t-1} + b_{hi}) \\ f_t = \sigma\left(W_{if}X_t + b_{if} + W_{hf}h_{t-1} + b_{hf}\right) \\ g_t = tanh\left(W_{ig}X_t + b_{ig} + W_{hg}h_{t-1} + b_{hg}\right) \\ o_t = \sigma(W_{io}X_t + b_{io} + W_{ho}h_{t-1} + b_{ho}) \\ c_t = f_t{}^{\circ}c_{t-1} + i_t{}^{\circ}g_t \\ h_t = o_t{}^{\circ}tanh(c_t) \end{gathered} \tag{2}$$

Among them, X_t represents the input of the t time step, h_{t-1} represents the output of the previous time step, i_t、f_t、g_t、o_t、c_t and h_t represent the input gate, forgetting gate, generation candidate state, output gate, cell state, and output state, respectively. The LSTM algorithm can effectively process sequence data, such as natural language text, and is also suitable for tasks such as 3D model generation and simulation. In the digital inheritance and innovation of art and culture based on VR technology, LSTM algorithm can be used to train neural network models to achieve automatic generation and interaction of cultural relics [14-15].

(3) Convolutional Neural Network (CNN)

$$y_{i,j} = \tau\left(b + \sum_{q=1}^{Q}\sum_{k-1}^{K} w_{q,k}X_{i+k-1,j+q-1}\right) \tag{3}$$

$X_{i+k-1,j+q-1}$ represents the local area in the input data, $w_{q,k}$ represents the weight in the convolution kernel, b represents the offset term, and τ represents the activation function. The CNN algorithm is mainly used for tasks such as image recognition and classification. In the digital inheritance and innovation of art and culture based on VR technology, the CNN algorithm can be used to classify and recognize cultural relics, or for tasks such as generating the appearance of cultural relics [16-17]. By performing convolution and pooling operations on input data, the feature information of cultural relics can be extracted, thereby achieving model training and prediction.

In short, VR technology and neural network algorithms are mutually reinforcing and complementary. By combining the two, it can provide stronger support and guarantee for the digital inheritance and innovation of art and culture based on VR technology [18-19].

3. Experimental Results on the Application of VR in the Digital Inheritance and Innovation of Art And Culture

3.1 Experimental Design

VR technology has great potential in the digital inheritance and innovation of art and culture [20]. In order to explore the application of VR technology in the field of culture and art, this article designed four sets of experiments to study the impact of VR technology in the field of art and culture from different perspectives.

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Experiment 1: Comparison of Visiting Experience between Virtual Museum and Traditional Museum

Select 20 groups of participants, 10 groups for virtual museum visits, and the other 10 groups for traditional museum visits. Select the same number, theme, and type of exhibits to visit in both virtual and traditional museums. Bring 20 groups of participants into the museum and ask them to visit all exhibits within the specified time frame, record the time they visited, and rate their interest in the exhibits.

The experiment aims to compare the visiting experience of virtual museums and traditional museums. Experimental indicator: Visiting time: Record the average time required for visitors to stay in two types of museums. Interest in exhibits: Using a questionnaire survey, visitors are asked to rate their interest in the exhibits they see. Information absorption rate: Examines visitors' understanding and cognition of the exhibits in the museum.

Experiment 2: The Impact of VR Technology on Art Purchase Behavior

It can select 20 groups of participants, 10 groups using VR technology for art purchases, and the other 10 groups not using VR technology for purchases. This article selects artworks of the same quantity, type, style, and value in art stores. This article brings 20 groups of participants into an art store, one group using VR technology to try on and wear art pieces, and the other group directly trying out art samples. Record the participants' desire, accuracy, and satisfaction ratings for the purchase of artworks.

The experiment aims to explore the impact of VR technology on art purchasing behavior. Experimental indicator: Art purchase rate: Observe whether the participants in the experiment are more likely to develop a desire to purchase after trying on and wearing art under VR technology. Accuracy: Record the participants' accurate judgments of product size and material after VR fitting and fitting. Satisfaction: Using a questionnaire survey, participants are asked to rate their purchasing experience after trying on and trying on.

Experiment 3: Comparison of Audience Participation between Virtual Performances and Traditional Performances

Select 20 groups of participants, 10 groups for virtual performance viewing, and the other 10 groups for traditional performance viewing. Select performances with the same theme and style in both virtual and traditional performances. Bring 20 groups of participants to the performance site, watch the performance, and record participation ratings, interaction times, and retention.

This experiment aims to compare the impact of virtual performances and traditional performances on audience engagement. Experimental indicator: Participation: Using a questionnaire survey, the audience is asked to rate their sense of participation in both virtual and traditional performances. Interactivity: Record the number of times the audience participated in the performance and their performance during the interactive session. Retention: By observing the return rate, sharing rate, and other indicators of virtual and traditional performances, we examine the impact of both forms on audience retention.

Experiment 4: Innovative Comparison between Virtual Art Creation and Traditional Art Creation

Select 20 groups of participants, 10 groups using virtual art creation for creation, and the other 10 groups using traditional art creation for creation. Select creations with the same theme and style in both virtual and traditional art creations. Bring 20 groups of participants into the creative scene to create and record the difficulty, achievement rating, and satisfaction rating of the creation.

This experiment aims to compare the innovation of virtual art creation and traditional art creation. Experimental indicator: Creation difficulty: Record the average time required for participants in virtual art creation and traditional art creation. Creative Achievement Rating: Using a professional rating system, score virtual and traditional art creations to measure their innovation. Creation satisfaction: Using a questionnaire survey, participants were asked to evaluate their satisfaction with two forms of artistic creation.

3.2 Experimental Results of Digital Inheritance and Innovation of Art and Culture

(1) Comparison of Visiting Experience between Virtual Museum and Traditional Museum

Figure 1 shows a comparative analysis of the visiting experience between virtual museums and

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traditional museums. Figure 1 (a) shows a visit to a virtual museum, and Figure 1 (b) shows a visit to a traditional museum. Table 1 shows the comparison of the mean values of visiting experience indicators.

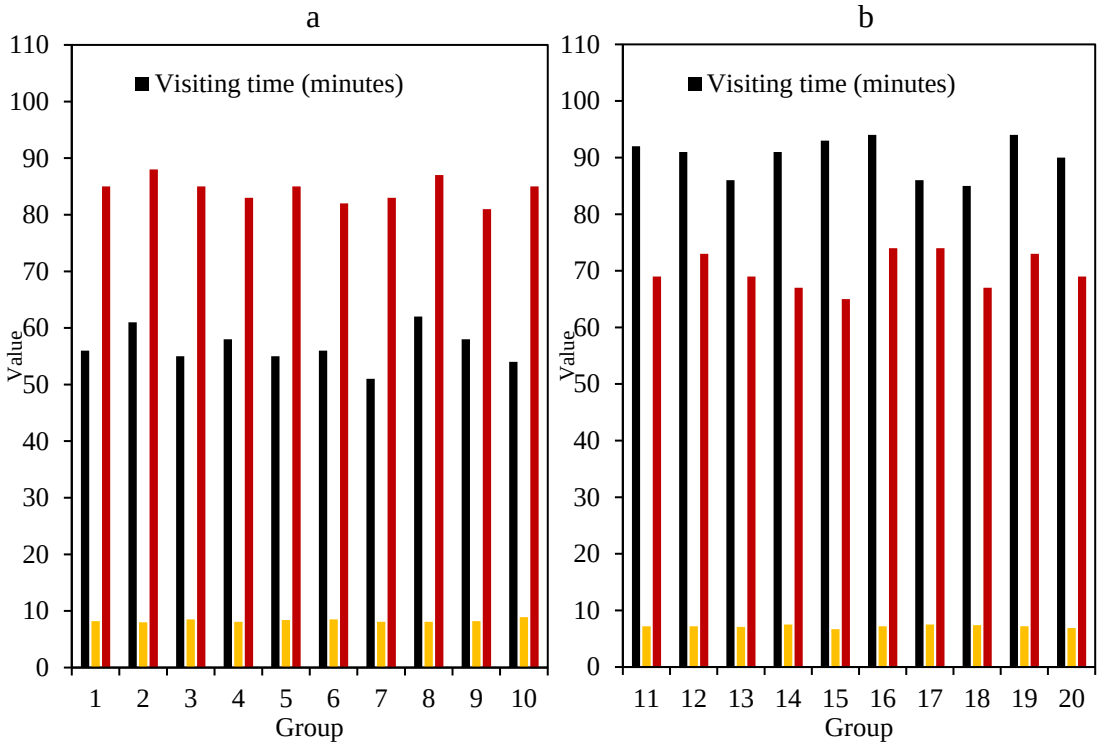

Figure 1(a): shows a virtual museum visit *Figure 1(b): shows a visit to a traditional museum*

Figure 1: Comparative Analysis of Visiting Experience between Virtual Museum and Traditional Museum

Table 1: Comparison of Average Visiting Experience Indicators

	Visiting virtual museums	Visiting traditional museums
Visiting time (minutes)	57	90
Interest in exhibits (points)	8.3	7.2
Information absorption rate (%)	84	70

From it, it can be seen that visitors using virtual museums spend less time (57 minutes, 90 minutes), have slightly higher interest in exhibits (8.3 points, 7.2 points), and have improved information absorption rates (84%, 70%) compared to those using traditional museums. This indicates that virtual museums can convey exhibition information faster, improve the efficiency of visiting experiences, and to some extent increase visitors' interest and information absorption rate.

(2) The Impact of VR Technology on Art Purchase Behavior

Figure 2 shows the impact analysis of VR technology on art purchase behavior. Figure 2 (a) shows the use of VR technology for art purchase, and Figure 2 (b) shows the use of VR technology for purchase. Table 2 shows the comparison of the average impact indicators of VR technology in art purchasing behavior.

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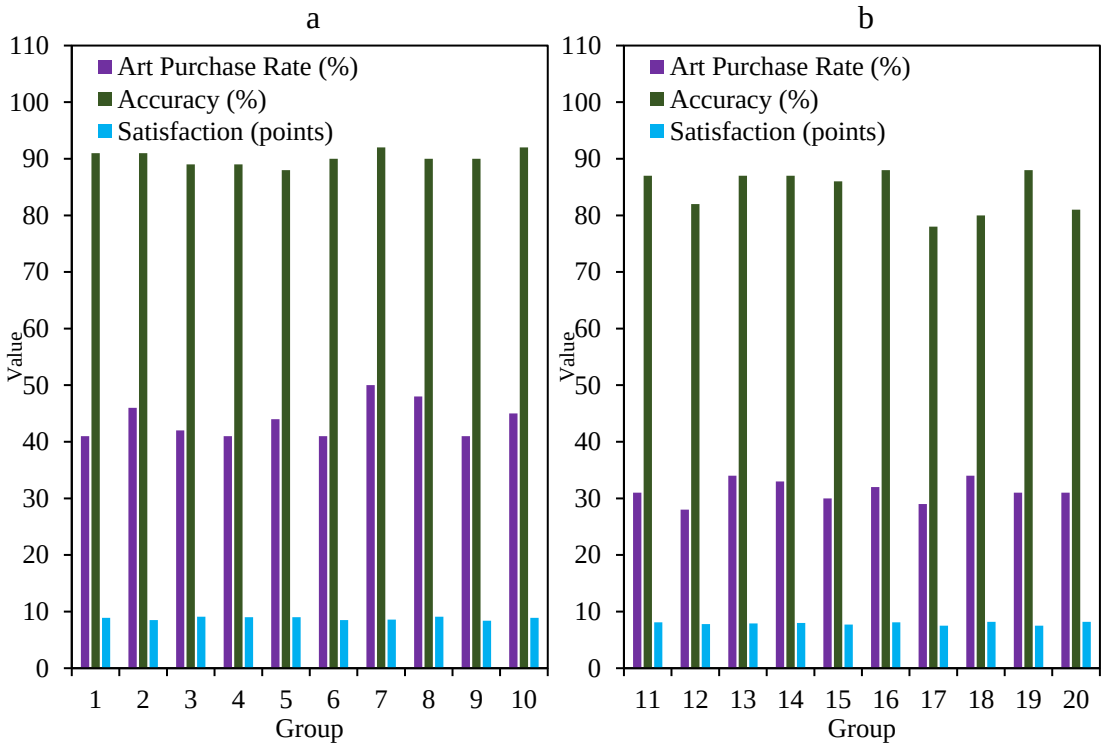

Figure 2(a): shows the use of VR technology for art purchase
Figure 2(b): shows purchasing without using VR technology

Figure 2: Analysis of the impact of VR technology on art purchasing behavior

Table 2: Comparison of the mean impact indicators of VR technology in art purchasing behavior.

	Using VR technology	Not using VR technology
Art Purchase Rate (%)	44	31
Accuracy (%)	90	84
Satisfaction (points)	8.8	7.9

From it, it can be seen that people who use VR technology to try on and wear art have a higher desire to purchase (44%, 31%) compared to those who do not use VR technology to try on and wear art. At the same time, the accuracy of judging size and material (90%, 84%) and satisfaction with the purchase experience (8.8 points, 7.9 points) are also higher. This indicates that the application of VR technology in art sales can enhance customers' perception and purchase intention of art, while also improving customer accuracy and satisfaction.

(3) Comparison of audience participation between virtual and traditional performances

Figure 3 shows a comparative analysis of audience participation between virtual performances and traditional performances. Figure 3 (a) shows watching virtual performances, and Figure 3 (b) shows watching traditional performances. Table 3 shows the comparison of the average audience participation indicators between virtual performances and traditional performances.

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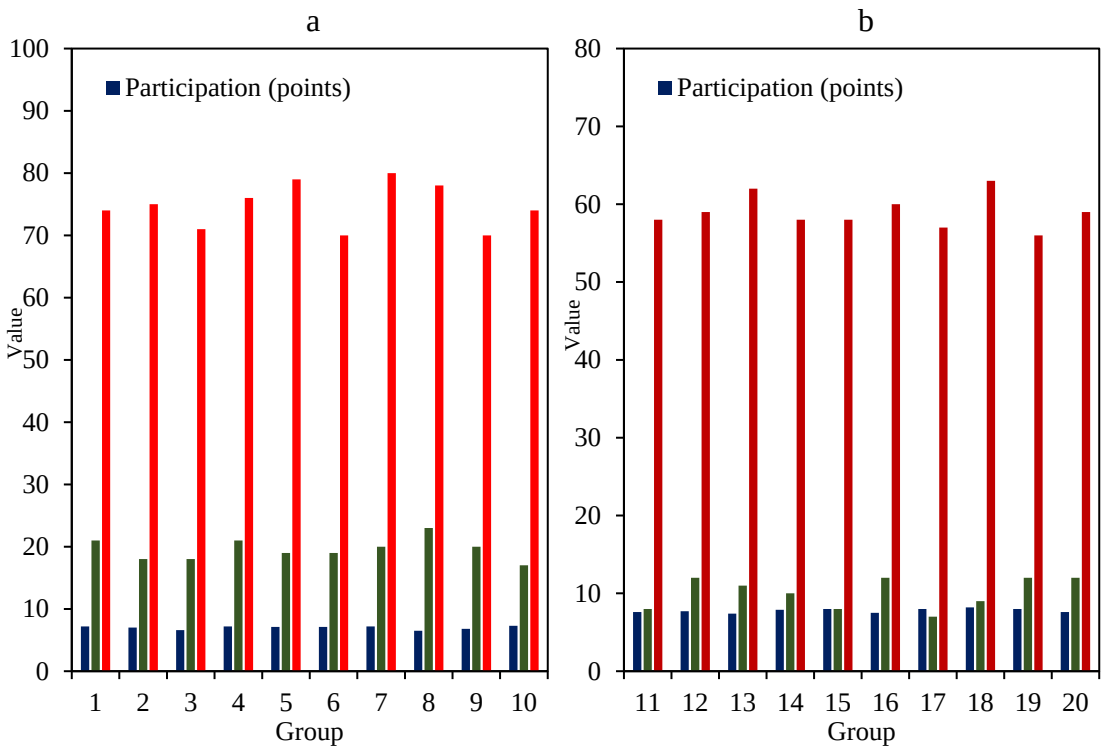

Figure 3(a): shows virtual performance viewing Figure 3(b): shows watching traditional performances

Figure 3: Shows a comparative analysis of audience participation between virtual performances and traditional performances

Table 3: Comparison of Average Audience Participation Indicators between Virtual Performances and Traditional Performances

	Conduct virtual performance viewing	Performing traditional performances to watch
Participation (points)	7.0	7.8
Number of interactions	20	10
Retention rate (%)	75	59

From it, it can be seen that the participation rating of virtual performances is slightly lower (7 points), but the interaction frequency of virtual performances is higher (20 times), and the retention rate has also improved (75%). This indicates that virtual performances can better meet the audience's interactive needs, increase interactivity and experience, and thereby improve audience retention.

(4) Innovative Comparison between Virtual Art Creation and Traditional Art Creation

Figure 4 shows a comparative analysis of the innovation between virtual art creation and traditional art creation. Figure 4 (a) shows the use of virtual art creation for creation, and Figure 4 (a) shows the use of traditional art creation for creation. Table 4 shows the comparison of the average innovation indicators between virtual art creation and traditional art creation.

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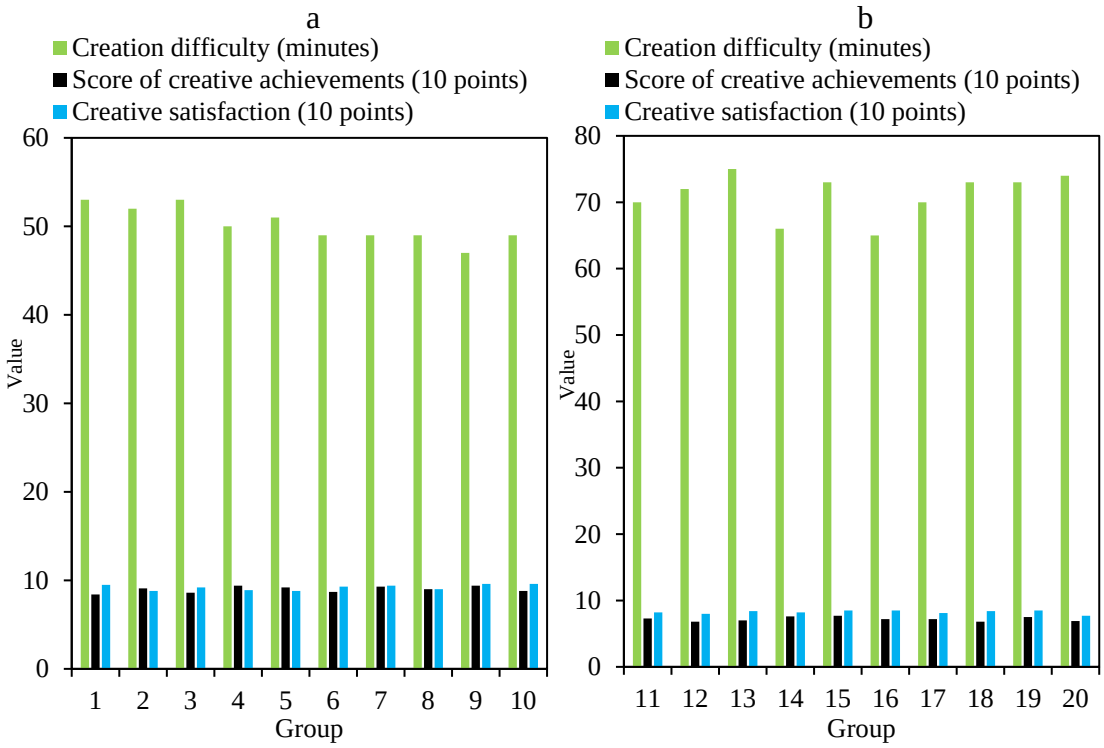

Figure 4(a): shows the use of virtual art creation Figure 4(b): shows the use of traditional art creation

Figure 4: Comparative Analysis of Innovation between Virtual Art Creation and Traditional Art Creation

Table 4: Comparison of the mean innovation indicators between virtual art creation and traditional art creation

	Creating using virtual art	Using traditional art creation
Creation difficulty (minutes)	50	71
Score of creative achievements (10 points)	9.0	7.2
Creative satisfaction (10 points)	9.2	8.3

From it, it can be seen that people who use virtual art creation to complete their creations faster than those who use traditional art creation (50 minutes, 71 minutes), and their creative achievement scores (9.0 points, 7.2 points) and creative satisfaction scores (9.2 points, 8.3 points) are also higher. This indicates that virtual art creation can improve creative efficiency and quality, while also increasing the satisfaction of creators.

Overall, the above experiments have studied the application of VR technology in the field of culture and art, revealing the advantages and potential of VR technology in multiple aspects. These experimental conclusions can provide useful references for the cultural and artistic community, helping them better utilize VR technology for digital inheritance and innovation.

4. Conclusions

In recent years, with the rapid development of VR technology, people have gradually begun to realize its potential and role in the field of culture and art. The digital inheritance and innovation of art and culture based on VR technology has become one of the hot topics today. This article found through experiments that virtual museums can transmit exhibition information faster than traditional museums, improve the efficiency of the visiting experience, and also increase the interest and information absorption rate of visitors to a certain extent; The application of VR technology in art sales can enhance customers' perception and willingness to purchase art, while also improving customer accuracy and satisfaction; Virtual performances can better meet the interactive needs of the audience, increase interactivity and experience, and thereby improve audience retention; People who use virtual art creation to complete their creations faster than those who use traditional art creation, and their scores for creative achievements and satisfaction are also higher. It can be seen that the application of VR

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technology in the field of culture and art has broad prospects and potential. Through the digital inheritance and innovation of VR technology, the field of culture and art can better preserve and promote traditional culture, while also exploring more artistic forms and innovative spaces.

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2) 2021 University-level fund project: "Research on innovative design of Baibuyao Cultural Tourism Products under the rural revitalization Strategy", Project number: XJ21KT15.

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