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Research Article

Practical Research on the Assistance of Music Art Teaching Based on Virtual Reality Technology

Jing Zhang

College of Music, Jilin Normal University, Siping, 136000 Jilin, China

Correspondence should be addressed to Jing Zhang; zhangjing@jlnu.edu.cn

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Music education in our country has a long history, but modern teaching started relatively late. In recent years, our country has continuously accelerated the pace of learning in the field of music education. The use of advanced Internet of Things virtual reality has become an important way for the development of music art education in our country. This paper studies the practical effects of music art teaching combined with the aid of the Internet of Things virtual reality technology. This article takes the Internet of Things virtual reality technology-assisted music art teaching as the research object and analyzes the effects and advantages of virtual reality technology in music art teaching. Search for topics such as "music" and "VR" through Google to find literature related to music and art. Get the latest rankings of different types of electronic music on YouTube, and through the audition and BPM screening, download music that meets the classroom practice of this article. Research results show that a teaching system that combines VR and augmented reality technology can shorten teaching time by 65%. The virtual reconstruction of music art using VR technology allows students to visually observe the form of music art. The combination of VR technology and traditional teaching methods significantly increases the initiative, interest, effectiveness, and participation of students in learning and can achieve better teaching results. VR system is used in music teaching. DentSim system, Moog Simodont, and dental trainer system can effectively help students master the basic methods of note preparation and actively improve the teaching quality of music professional courses.

1. Introduction

Music education in China has a long history, but modern education started late. In recent years, the pace of learning in the field of music education in China has been accelerating. The use of advanced computer-assisted virtual reality has become an important method for the development of Chinese music and art education. However, most of the current researches focus on the music art itself and separate the music art to study its characteristics. There are still shortcomings in the comprehensive music art combined with virtual reality technology of the Internet of Things to assist education. Virtual reality is a combination of multiple technologies, including real-time 3D computer graphics, wide-angle (wide-field) stereoscopic display, and tracking of the observer's head, eyes, and hands, as well as tactile/force feedback, stereo, network transmission, and voice input and output technology.

The Han Y experiment proved that the virtual music room has an irreplaceable role in promoting students' learning music structure [1]. Jiang Z proposed that the "Musical Note Art" course is a high-pitched and low-pitched artistic training based on the standard note form. It is a practical training course to help students master the note form. It is the first technical course for music and art students, which can effectively train. The ability of students to combine hands and eyes has a vital role in cultivating students' operating habits [2]. On the basis of traditional musical note art, virtual art is added. The main conclusions of Rubinstein R's research are the same. The original virtual reality ecological music is mainly original and unique folk music produced in different natural arts, which is the life of local residents [3]. Slizovskaia O's many related achievements on "Music Art Teaching" and his attention to "Soundscape Art" are closely related to the artistic diversity of ethnic regions [4]. Peeters G discussed the relationship between

the aesthetic theory of art philosophy and the diversity of music culture and put forward the idea of strengthening "artistic rationality" to facilitate the symbiosis of cultural diversity. He believed that in Chinese culture, Laozi proposed the concept of "harmony" and "artistic rationality" [5].

Allen also compares the diversity of music and art teaching with the "intraspecies diversity" in art and believes that the diversity of individuals within the population of organisms is a means to prevent intraspecies organisms from suffering from genetically similar epidemics, while maintaining national culture. Diversity is one of the prerequisites to ensure the sustainable and healthy development of various human civilizations [6]. Dutã M proposed 9 research directions of music aesthetics worthy of attention, which are important achievements of guiding value in the research of art aesthetics in the music industry in our country [7]. Wang DX elaborated on the level of music art aesthetics research and the direction of combining virtual reality art music aesthetics research with art aesthetics [8]. Zhao SM analyzed the integration of music and nature insisted in Taoist music aesthetics. From the perspective of music criticism, he analyzed the artistic aesthetics of the ancients' music thoughts and discussed the ancients' artistic philosophy from different perspectives [9]. Shi YJ put forward three states of the relationship between man and nature and explained the interdependence and mutual recognition of nature, human and musical instruments from the production of Chinese musical instruments, and the characteristics of playing sound and their breathing characteristics [10].

This paper studies the practical effects of music art teaching combined with the aid of virtual reality technology. This article uses virtual reality technology to assist music art teaching as the research content and analyzes the effects and advantages of virtual reality technology in music art teaching. The music used in this research is divided into fast-paced music, and the music type is electronic music. Through consultation with music art course coaches and electronic music producers, combined with relevant literature, it can be known that music art is most suitable for a fast-paced music environment. Search for topics such as "music" and "VR" through Google to find literature related to music and art. Get the latest rankings of different types of electronic music on YouTube, and through the audition and BPM screening, download music that meets the classroom practice of this article.

2. Virtual Reality Technology and Music Art

2.1. The Internet of Things Virtual Reality Technology and Music Aesthetics. Music is the expression of human emotions and thoughts. It has multiple functions and values. The origin of music in human society can be traced back to the very ancient times. When human beings have not yet produced language, they already know how to express their meaning and feelings by using the level and strength of sounds. With the development of human labor, the chants of unified labor rhythm and the shouting of information are gradually produced. This is the most primitive form of music; when people celebrate the harvest and share the fruits of labor, they often beat stone tools and wooden tools to express joy; this is the prototype of the original musical instrument [11]. When discussing music art teaching in the USA, music art teaching has made a systematic interpretation of the functions of music. He brilliantly summarized the value of music functions as "We are perfec. The human nature of the people needs to be embodied by music," emphasizing that the value of music lies in the emotional expression of the rhythm of life and the reproduction of poetic romance [12]. From a variety of perspectives and from the perspective of their respective disciplines, the consensus on the function of music is to highly agree that music is an invisible spiritual force and an indispensable source of wisdom for the civilization and development of human society. At the same time, music is closely connected with nature and culture [13]. The development of musicology needs to conduct cross-research with other disciplines, which has been widely recognized in the industry, reflecting the artistic awakening of literature and art and the distinctive characteristics of synchronous development with the times [14]. Music art emphasizes "a kind of center," advocating order and elite culture, belonging to the category of the beauty of reason, and insisting on modernism of rationality, universality, and order. However, postmodernism has had a huge impact on the development of musicology, especially a breakthrough in the traditional aesthetic order [15]. The rise of "music art" has enabled musicology to embed the concept of artistic beauty into the creation of works under the idea of respecting differences and pursuing diversity, so as to guide the people's artistic attention and enhance the people's artistic sentiment [16].

The Internet of Things (IoT) is a network based on information carriers such as the Internet and traditional telecommunication networks, which enables all ordinary objects that can perform independent functions to achieve interconnection [17]. The Internet of Things has developed since its birth, and it has the most complete professional product series in the industry, covering various applications from sensors, controllers, to cloud computing. Its products and related services cover smart home, transportation and logistics, environmental protection, agricultural production, public safety, intelligent fire protection, industrial monitoring, personal health, and other fields. The Internet of Things will be the next "important productive force" to promote the rapid development of the world. On the one hand, it can improve economic efficiency and greatly save costs; on the other hand, it can provide technical impetus for the recovery of the global economy.

The rise of virtual reality stems from the crisis caused by art issues to human survival, and the world has begun to reexamine the development model of human society and the relationship between man and nature [18]. Virtual reality, also known as virtual technology and virtual environment, is a brand new practical technology developed in the twentieth century. Users feel as if they are there, seeing things in three-dimensional space instantly and without restrictions. These worldwide actions are several major leaps in the implementation of the concept of sustainable development by mankind and demonstrate the seriousness of the art problem [19]. From the perspective of the time sequence of academic development, Chinese art aesthetics is mainly established based on the originality of Chinese culture. It has profound background and great potential for tapping.

It emerged from the art protection movement and green development triggered by the global art crisis. Music and art education and all kinds of virtual reality art music are important components included in it [20].

Virtual reality art music also has titles such as green music and environmental music. Therefore, it can be summarized as "in order to praise the harmonious beauty of nature and all kinds of life in it, or to satirize and criticize special nature and social bad phenomena, and to promote artistic values and music protection ideas are the collective name of music whose main content is," which belongs to the category of artistic aesthetics [21]. This type of music explores the relationship between man and nature from the perspective of creation and auditory perception [22]. The research in this area existed and developed before Ellens Allen proposed "Ecomusicology", especially in areas such as music art teaching and biomusicology [23]. In fact, China's early artistic ideology had a profound impact on the value of virtual reality art and music. Some scholars call it "pre-modern." The philosophical point of view is to treat man and nature as a whole. Many philosophical thoughts of ancient Chinese have also been absorbed in the postmodern context about music and nature and music and culture [24]. Therefore, the study of music aesthetics in our country should attach great importance to the excavation of artistic ideas in Chinese classical music, highlighting the national cultural self-confidence [25].

2.2. Music Development and VR Music. Musicians use the adjustment function of "VR music" to participate in the research of noise management, use sound adjustment methods to eliminate noise pollution to improve the living sound, or play the psychological adjustment role of VR music to improve the work efficiency of workers. In the 1970s, the Japanese musician Hattori published the book "VR Music Aesthetics," which is the result of joint research by experts in Japanese literature, sound engineering, music psychology, architectural engineering, and media. In this multidisciplinary research, art and music are considered to be the constituent disciplines governing sound art. Combining the strategic needs of building an artistic civilization, Zhang Jianguo put forward in VR music research that "music originates from objective art and affects subjective art [26]. The popularization of environmental awareness has provided aesthetic standards for the humanized service of VR music, and other viewpoints, which clearly summarize and express the function and meaning of music art. Music art psychology is also a branch subject where musicology and art science intersect. Research in this area pays more attention to artistic issues. Li Shuangyan systematically discussed interdisciplinary research issues in various fields.

Soundscape research is a way of expression in the form of "Apocalypse.". Researchers in this field in our country are mostly concentrated in the fields of physical acoustics, architectural acoustics, and art science. Music scholars' interdisciplinary research in this area is still relatively weak, and their results are only seen in postgraduate papers, and they are the current research status at home and abroad. For example, Tao Bo analyzed, categorized, and interpreted the literature design examples of domestic sound landscape research and put forward some suggestions and opinions. Jiao Ying's thesis is about the exploration of the development of virtual reality art musicology and music acoustics in our country. Han Baoqiang and Zi Minjun also covered this aspect in their writings on the value of music in the universe and human life. At the Biomusicology Symposium held in Florence, it was established that the main research directions in this field are evolutionary musicology, comparative musicology, and neuromusicology, especially animal song types with cultural characteristics and various forms, and human music, comparing music scores to grasp the characteristics of animals. Compared with other cross-border research, it is more difficult, so the results are relatively few. Although research in this field is still in its infancy, it is a subject that interests researchers in many disciplines, and it is also of great significance to the study of virtual reality art and music.

Some studies have put forward the development and research focus of virtual reality art musicology from the perspective of research goals; that is, virtual reality art musicology research should answer the three questions of the relationship between music and nature, how music depends on nature, and how music reflects nature. Define what is virtual reality art musicology. The main purpose of this definition is to clarify three issues: One is that the main subject of virtual reality art musicology is still musicology, and it has a "species-genus" relationship with musicology; the other is that it is affected by the background of its production. The special focus is on the issues of art and sustainable development facing human society. The purpose is to use the educational function of musicology to arouse people's awareness of art protection and the cultivation of artistic civilization quality; the third is to persist in and follow the artistic beauty of music creation and the concept of an important power source, through the intersection and absorption of related theories and research methods, to expand the horizon of music creation, and to better play the function of musicology in serving society and educating people. This definition also answers two basic questions. The first is whether "virtual reality art musicology" meets the cross-disciplinary conditions, and virtual reality art musicology meets the subject "cross-border" research, which mainly reflects the following: First, the subject is clear, and it is still musicology; second, it follows modern art, the role of the academic paradigm of science, and the practice of cross-research in aesthetics and the expansion of musical expressions; and third, it has the development potential to expand to a wider range of academic theory and a deeper level of discipline. The second question answered is the main interface between "musicology" and "art sciences", which is discussed in detail below with respect to the three research goals proposed by Aaron. However, the cross-border research of virtual reality art musicology involves many disciplines and related fields such as work creation, soundscape art, art science, biology, and art. The research object is also a socio-economic-natural composite art system, which has a "cross-dissolving" multiple cross-border research conditions and advantages.

2.3. Music and Art Mixed Data Training Model of Virtual Reality. As mentioned in the overview of this article, reliance on the labels of training data is now a major limitation of hybrid data analysis and recognition. Deep neural networks

refer to new speech recognition software that works by imitating the way the human brain thinks, allowing the software to recognize speech faster and with higher accuracy [27]. Specifically in the field of mixed music analysis, the training process of deep neural network (DNN) and other methods must first mark the mixed data for training:

$$E = \frac{\sum_{j=1}^{k}\sum_{h=1}^{k}\sum_{t=1}^{n_j}\sum_{r=1}^{n_h}\left|y_{ij} - y_{hr}\right|}{2n^2u}. \tag{1}$$

These labels are generally manually labeled with a lot of work and usually only include the main instrument type labels. They have no ability to measure the intensity changes of secondary instruments, and the accuracy of the labels cannot be guaranteed for mixed data composed of several components of similar intensity:

$$D_A = E_w + E_{nb} + E_t - Ic. \tag{2}$$

Assuming that there is a data y sample and two different sparse dictionaries Da, Db where Da and y are used for data set training, and Db is used for data set training alone, formula (3) can be obtained:

$$y = (\mathrm{Da} \times \mathrm{Db}) - 1, \tag{3}$$

$$E_j = \frac{1/2u_j\sum_{i=1}^{n_j}\sum_{r=1}^{n_j}\left|y_{ji} - y_{jr}\right|}{n_j^2}, \tag{4}$$

$$Ew = \sum_{j=1}^{k} G_{jj}p_j s_j. \tag{5}$$

Therefore, if the sample y uses Da and Db to model the coefficient vectors, respectively, va, vb, it is easy to know

$$\begin{aligned} V_b &= \frac{\sum_{Z=1}^{h_j}\sum_{r=1}^{n_h}\left|y_{ji} - y_{hr}\right|}{n_j n_h\left(u_j + u_h\right)}, \\ Va &= \sum_{j=2}^{k}\sum_{h=1}^{j-1} G_{jh}\left(p_j s_h + p_h s_j\right)D_{jh}, \\ y_t &= \sum_{j=2}^{k}\sum_{h=1}^{j-1} G_{jh}\left(p_j s_h + p_h s_j\right)D_{jh}\left(1 - D_{jh}\right). \end{aligned} \tag{6}$$

By analogy, all the components in y have higher maximum correlation with the dictionary Da, and the expected value of single coefficient is higher. It can be seen that the sparse dictionary with more concentrated energy and better sparsity performance of coefficient vector has higher matching ability with the samples; that is, if the energy distribution of coefficient vector can be accurately measured, the measurement result will be given clear semantic information in the matching degree between the data sample and the dictionary of specific components. In this way, we can only use labeled single component data and unlabeled mixed source data to realize mixed source data identification and further data analysis on semantic level without relying on mixed source data labels.

$$M = \frac{d_{jh} - P_{jh}}{d_{jh} + P_{jh}}. \tag{7}$$

Because the music signal itself is composed of a small number of determined single tones, and the random artistic intensity of the music signal set is relatively low, the data set must have sparsity, so it is suitable to use the sparse decomposition algorithm for analysis. When the music index is regarded as a sparse feature, the calculation formula can be defined as follows:

$$\begin{aligned} \ln\left(\frac{FI_{it}}{FI_{it} - 1}\right) &= \alpha + \beta \ln FI_{it} - 1 + \phi X_{it} - 1 + \nu_i + \tau_t, \\ d_{jh} &= \int_0^{\infty} dF_h(y)\int_0^{y}(y - x)dF_j(y). \end{aligned} \tag{8}$$

Parameter selection is one of the most important factors affecting the performance of sparse decomposition algorithm, including frame length, dictionary modulus, and sparsity constraint (the number of atoms used in sparse modeling). For the more common music signal with 44.1 KHz sampling rate, the central C (261.63 hz) can be taken as the reference to ensure at least one complete waveform in each frame. Generally speaking, 256 sampling points is an appropriate frame length

$$\begin{aligned} f(x) &= \frac{1}{Nh}\sum_{i=1}^{N} k\left(\frac{X_i - x}{h}\right), \\ k(x) &= \frac{1}{\sqrt{2\pi}}\exp\left(z - \frac{x^2}{2}\right). \end{aligned} \tag{9}$$

In general, 1024 or 2048 dimensional dictionaries can meet the requirements of most solo or chamber music audio analysis. Considering the multiple harmonics and artistic conditions in the general music signal, the optimal sparsity constraint for solo and chamber music is generally no more than 10, while that for symphony is about 35.

$$\begin{aligned} h_t &= \tanh\left(w_c x_t + u_c(r_t \Theta h_{t-1}) + b_c\right), \\ h_t &= z_t \Theta h_{t-1} + (1 - z_t)\Theta h_t. \end{aligned} \tag{10}$$

The output of the simulation (i.e., the fitness values of all members of the sub population) is sent back to the master node to perform evolutionary operations (i.e., selection, cross-over, and mutation) and finally select the first generation of pareto fronts.

$$P = \sigma t = \frac{\sqrt{1/n\sum_{i=1}^{n}(FI_{it} - FI_{it})^2}}{FI_{it}},$$
$$u_{(j|i)} = w_{ij}A_i, \tag{11}$$
$$s_j = \sum_i c_{ij}u_{(j|i)}.$$

After determining the dictionary learning parameters, it is necessary to train the dictionary for each basic instrument or instrument combination. All dictionaries need to use the same parameter training, especially the sparsity constraint, to ensure that the calculated SPI value will not be affected. According to different recognition needs and data conditions, we can arbitrarily select the dimension of component dictionary and SPI features. Taking string quartet as an example, we can train four kinds of dictionaries, namely, violin, viola, cello, and string quartet, respectively. Each frame sample uses these four kinds of dictionaries to model and calculate SPI.

$$\ln\left(\frac{PI_{it}}{PI_{it}-1}\right) = \alpha + \beta \ln PI_{it} - 1 + v_i + \Im_t. \tag{12}$$

In order to improve the recognition accuracy, more dictionaries can be trained, and more SPI time series feature vectors can be obtained by introducing the data of several instrument ensemble, or only a few instrument training dictionaries with reliable data can be used, which gives higher flexibility to the application of this method. Due to the uncertainty of the sparse decomposition algorithm, the SPI time series need to be smoothed for observation and analysis

$$\ln\left(\frac{FI_{it}}{FI_{it}-1}\right) * k_{t1}[i] = \sum_j \cos\left(w_i^1, w_j^2\right) + \alpha + \beta \ln FI_{it} - 1 + \phi X_{it} - 1 + v_i + \tau_t,$$
$$\theta = -\frac{1}{T}\ln(1+\beta). \tag{13}$$

The longer the window length, the better the stability of the algorithm, but the time resolution will decrease accordingly. When the frame length is 256 sampling points and the overlap between frames is 50%, 400-800 frames is a suitable range. Because the smoothing window will cover a certain length of time, the analysis results will produce a fixed length of delay when compared with the real music signal changes.

3. Music Art Teaching Assisted by Virtual Reality Technology

3.1. Objects. This paper takes the virtual reality technology-assisted music art teaching as the research object and analyzes the effect and advantages of virtual reality technology in music art teaching.

3.2. Methods

3.2.1. Get Music. Through Google to search "music" and "VR" and other topics, find music art-related literature. Google is recognized as the world's largest search engine company and has ranked first in the "Top 500 World Brands" list compiled by the World Brand Lab. Get the latest ranking of different types of electronic music on YouTube, and download the music in line with the classroom practice of this article through audition and BPM screening.

3.2.2. Teaching Environment. The music used in this study is divided into fast-paced music, and the music type is electronic music. Through the consultation of music art course coach and electronic music producer, combined with the relevant literature, we can know that music art is the most suitable in the fast-paced music environment. Because the beat of this kind of music is 120-140 bpm (beats per minute), it is beneficial to enhance the secretion of excitatory hormone in music.

3.2.3. Teaching Equipment. Teaching equipment is divided into music equipment, measuring instruments, and music environment to create suitable music. Professional high and low sound equipment and adjustment equipment are used in the music environment, and professional DJ controller and playing software are used in the music player to ensure the output quality of music.

4. The Internet of Things Virtual Reality Technology-Assisted Music Art Teaching Practice

4.1. VR Music Art Teaching Auxiliary Education System Model Analysis. The whole system based on VR is shown in Figure 1. It is composed of VR music art teaching guidance service system, music art, and virtual reality art. By using DT technology, the equipment data parameters in music art are input into VR music art teaching guidance service system. The service system integrates teaching process data to drive teaching guidance solution, so as to establish virtual connection between music art and virtual reality art.

As shown in Table 1, VR technology, as a product of teaching reform in the information age, has been widely used in the theoretical learning and practical training of music courses. This teaching method helps to realize the idealization of teaching and the high efficiency of learning. Specifically, it can improve the teaching method, optimize the training mode, and enhance the combination of foundation and classroom. But at present, VR technology is not perfect; its clarity, comfort, accuracy, scope of application, and modeling ability still need to be improved; and the next stage still needs further research to improve the existing technology.

As shown in Figure 2, a model system is built by taking teaching equipment as an example. Among them, the VR auxiliary system for music art teaching mainly includes note recognition and matching, data processing of teaching objects, virtual art music teaching, natural interaction, and music art teaching guidance. Virtual reality art includes the construction of mixed reality development art, the design of virtual reality assistance systems, the model of teaching equipment, the construction of note IDs, and the matching of guidance process segments.

As shown in Figure 3, with the help of twin data, the sensor data from music art can be fused, and the note category data, teaching scene data, three-dimensional music data, and

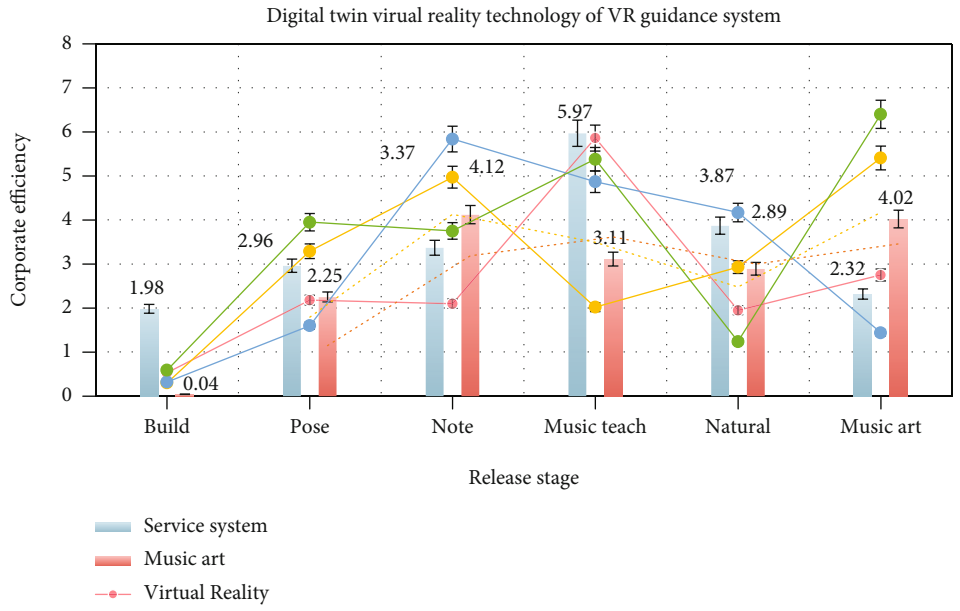

Figure 1: Digital twin virtual reality technology of VR guidance system.

Table 1: Theoretical learning and practical training of music courses.

Item	Service system	Music art	Virtual reality	DT technology	Drive teaching	Guide solution
Build	1.98	0.04	0.53	0.3	0.32	0.59
Pose calibration	2.96	2.25	2.18	3.29	1.6	3.95
Note	3.37	4.12	2.1	4.97	5.84	3.75
Music teaching	5.97	3.11	5.86	2.02	4.87	5.38
Natural	3.87	2.89	1.95	2.93	4.17	1.24
Music art	2.32	4.02	2.75	5.41	1.44	6.4

interactive instruction data can be input into virtual reality art to realize the data drive of virtual reality art by the service system, make music art and virtual reality technology realize the integration of virtual and reality, two-way mapping and simulation early warning provide valuable teaching data information for teaching staff, and realize data interaction between people and virtual reality system.

As shown in Table 2, the whole system is operated interactively with GUI operation panel. The teaching art perception module realizes the collection of 3D data feature points, the tracking of teaching objects, and the pose calculation of the camera in the real teaching scene. The virtual reality art music teaching module restores the three-dimensional scene coordinate points, matches the VR spatial coordinate system in hololens glasses, adopts the matching method based on natural feature points, and carries out music teaching between the teaching guidance solution and the real teaching scene, so as to realize the virtual reality fusion and registration visual experience effect.

As shown in Figure 4, in the complex teaching process, the virtual reality solution must be superimposed on the key parts of the equipment in the real scene and maintain a high degree of geometric consistency, note consistency, and time consistency with it. The system needs to track the object and students' observation position in real time to achieve high-precision 3D music in virtual space.

As shown in Table 3, the collected note signal is sent to the teaching guidance service system to classify the note data, match the teaching guidance solution, and call the corresponding solution stored in the music and art teaching guidance process library. Through the camera on hololens, teachers can collect the teaching art on site and feed it back to the service system to revise the teaching guidance process in real time. If the music notes are difficult to judge, remote expert online guidance can be used to intervene the on-site teaching art, so as to realize the two-way mapping of music art teaching data between virtual reality art and music art.

4.2. Implementation Method of VR Assistant System for Music Art Teaching Oriented to Virtual Reality. The technical framework of VR auxiliary system for music art teaching of virtual reality technology is shown in Figure 5, which mainly includes note recognition and matching module and music art teaching guidance module. Note recognition and matching module are responsible for collecting the sensor signal on the real device, recognizing and classifying the

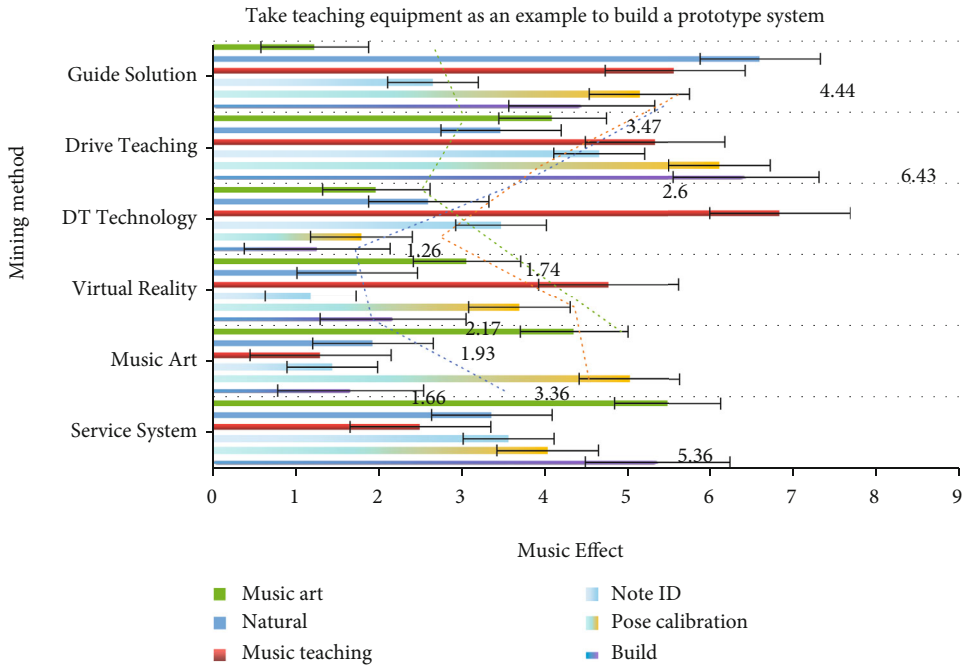

Figure 2: Take teaching equipment as an example to build a prototype system.

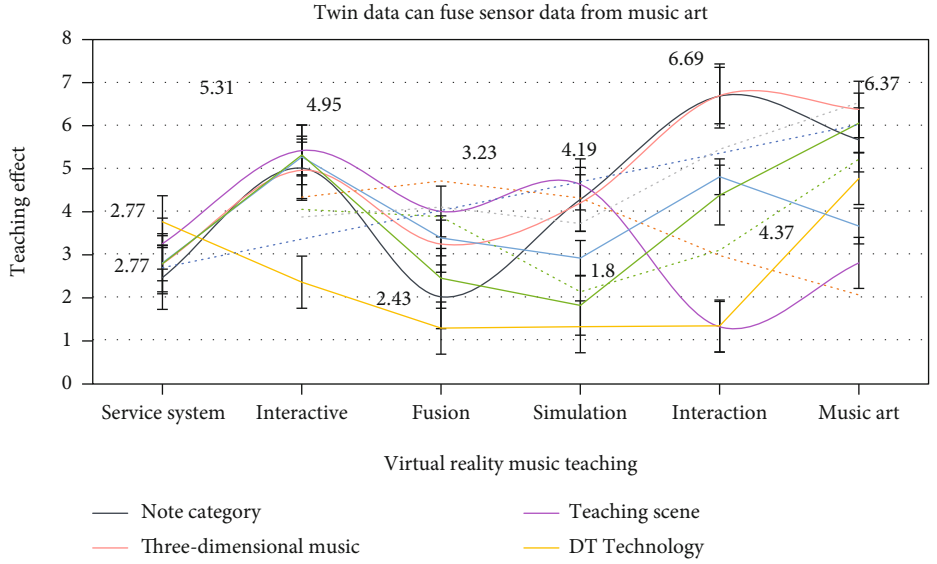

Figure 3: Twin data can fuse sensor data from music art.

Table 2: Interactive operation of the entire system combined with GUI operation panel.

Item	Note category	Teaching scene	DT technology	Drive teaching	Guide solution
Service	2.45	3.24	3.75	2.79	2.77
Interactive	5	5.41	2.34	5.26	5.31
Fusion	2	3.99	1.27	3.37	2.43
Simulation	4.27	4.62	1.3	2.9	1.8
Interaction	6.68	1.3	1.32	4.8	4.37
Music art	5.66	2.79	4.76	3.65	6.05

note signal, establishing the note tree model of the key parts of the device, forming the note ID identification number, and storing it in the note collection library to match with the teaching guidance solution in the music art teaching guidance module.

As shown in Table 4, the music art teaching guidance module integrates scientific teaching guidance methods according to different types of teaching virtual reality technology teaching technical manuals, stores them in the music art teaching database, conducts virtual simulation of teaching guidance process in the virtual interactive interface, and presents the teaching experience in combination with teaching history videos,

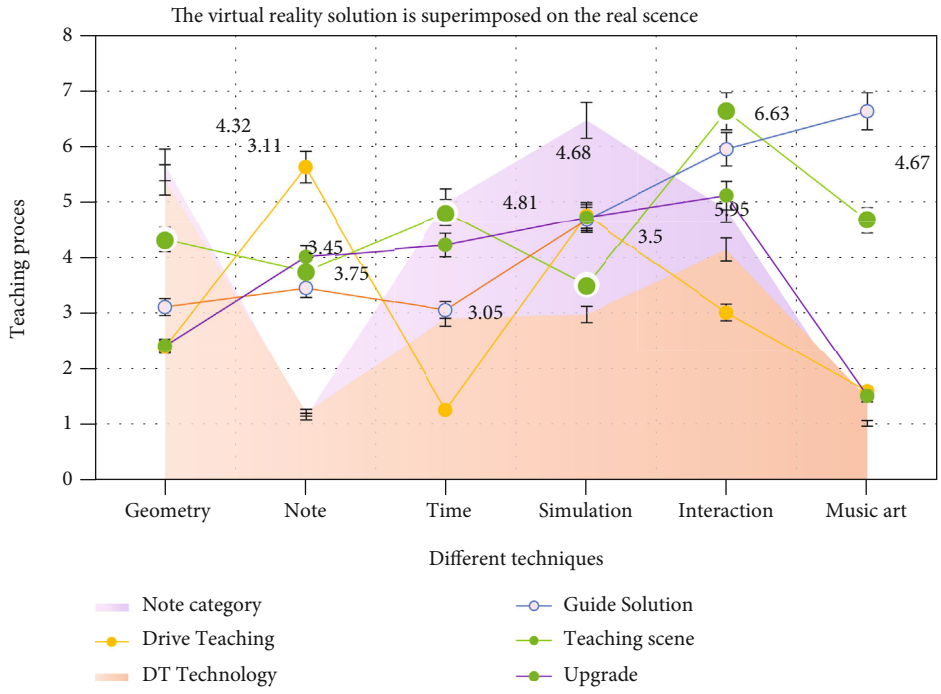

Figure 4: The virtual reality solution is superimposed on the real scene.

Table 3: Teaching guidance service system classifies its musical note data.

Item	Note category	Teaching scene	DT technology	Drive teaching	Guide solution	Upgrade
Geometry	5.67	4.32	5.4	2.39	3.11	2.41
Note	1.13	3.75	1.2	5.63	3.45	4.01
Time	4.99	4.81	2.9	1.25	3.05	4.22
Simulation	6.47	3.5	2.97	4.76	4.68	4.72
Interaction	4.87	6.63	4.14	3.01	5.95	5.12
Music art	1.01	4.67	1.46	1.58	6.63	1.5

teaching guidance process fragments, remote expert guidance, and other methods of learning guidance program.

As shown in Figure 6, virtual and real music teaching algorithms commonly used in hybrid reality technology include music algorithm based on virtual reality and music algorithm based on natural feature points. Both methods can solve the problem of spatial geometry consistency in 3D music teaching technology. As shown in Table 5, the music algorithm based on virtual reality has high accuracy and strong robustness, and can achieve stable positioning effect, but the actual teaching art is bad, which is easy to cause virtual reality damage. Compared with the virtual reality music algorithm, the music algorithm based on natural feature points can better satisfy the unmarked music in the teaching process. However, due to the complexity of teaching physics and art, it is easy to have the cumulative error of key frames, which easily leads to the loss of teaching target tracking in the teaching process. According to the characteristics of system development, the research of music algorithm based on natural feature points of video sequence is more in line with the interactive psychology of teaching staff.

The teaching process of virtual reality music art is shown in Figure 7, which is mainly divided into the steps of extracting scene feature points, feature point matching, camera pose estimation, pose correction, and camera pose confirmation. The system compares the reference frame image in the database with the current frame image collected by the hololens camera, matches its image feature points, and superimposes the virtual scene to realize virtual reality and fusion display of the guidance scheme in the real teaching scene.

As shown in Figure 8, the current music practice class mainly focuses on the art of note form, but ignores the music training of music art, which makes it more difficult for students to learn craniofacial music. Music is an interdisciplinary basic subject. Due to the lack of classroom experience and weak abstract thinking ability, the traditional "cramming" teaching makes it difficult for students to understand the relevant knowledge thoroughly, and it is more difficult for them to

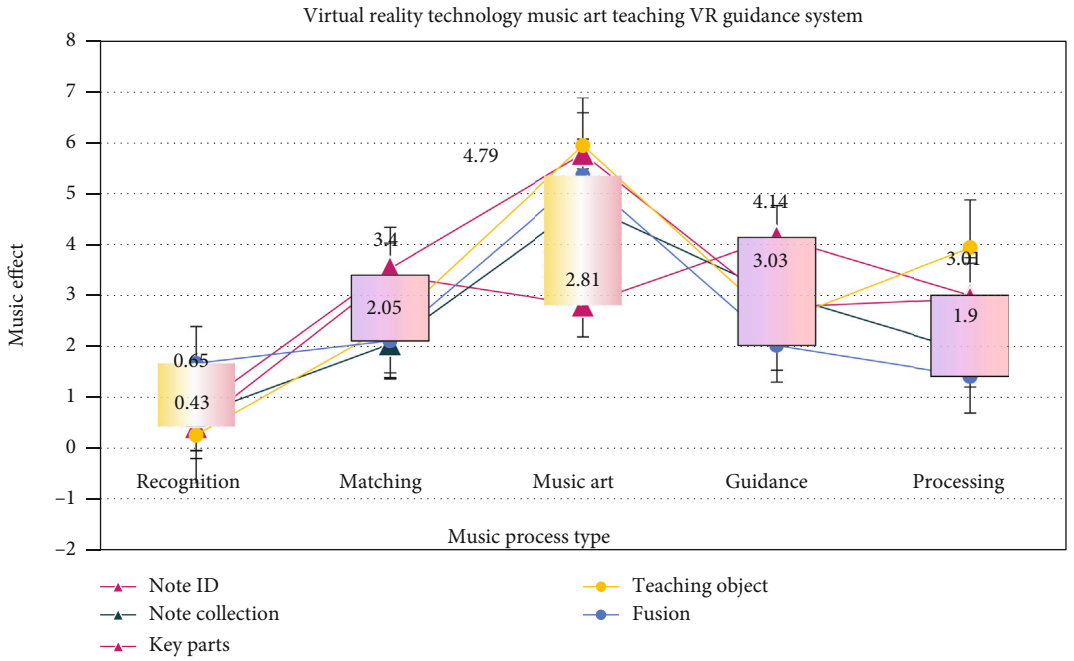

Figure 5: Virtual reality technology music art teaching VR guidance system.

Table 4: Music art teaching guidance module according to different models.

Item	Note ID	Note collection	Key parts	Teaching object	Fusion
Note recognition	0.43	0.65	0.77	0.26	1.67
Matching module	3.4	2.05	3.53	2.42	2.11
Music art	2.81	4.79	5.78	5.94	5.35
Teaching guidance	4.14	3.03	2.77	2.47	2.02
Data processing	3.01	1.9	2.94	3.94	1.42

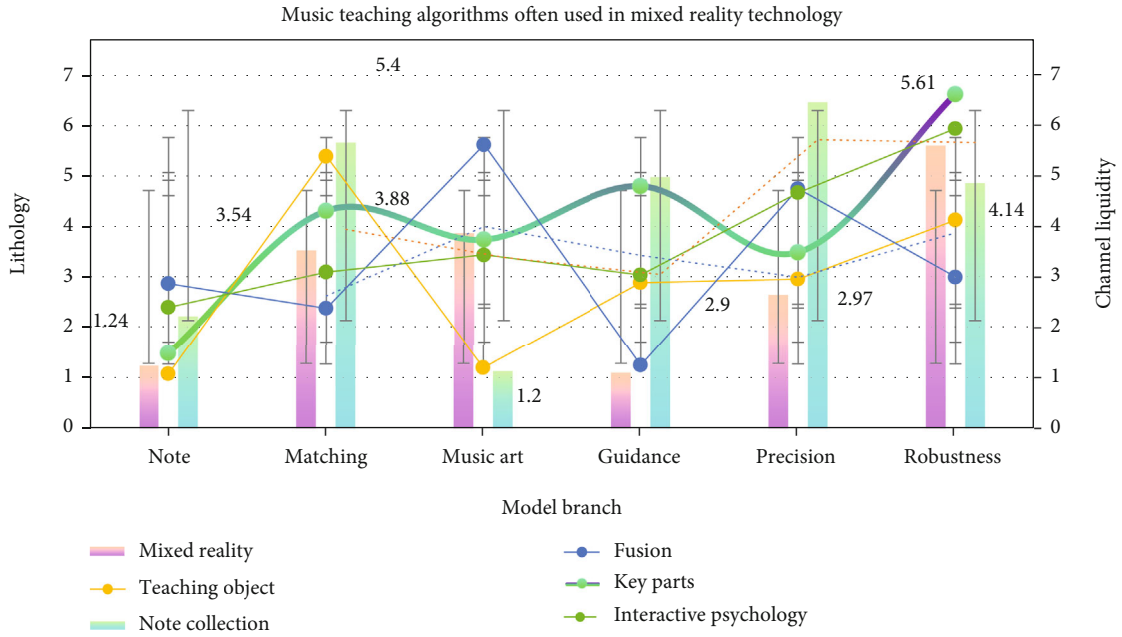

Figure 6: Music teaching algorithms often used in mixed reality technology.

Table 5: Music algorithm based on virtual reality.

Item	Mixed reality	Note collection	Teaching object	Fusion	Interactive psychology
Note recognition	1.24	2.23	1.08	2.88	2.41
Matching module	3.54	5.67	5.4	2.39	3.11
Music art	3.88	1.13	1.2	5.63	3.45
Teaching	1.1	4.99	2.9	1.25	3.05
Precision	2.66	6.47	2.97	4.76	4.68
Robustness	5.61	4.87	4.14	3.01	5.95

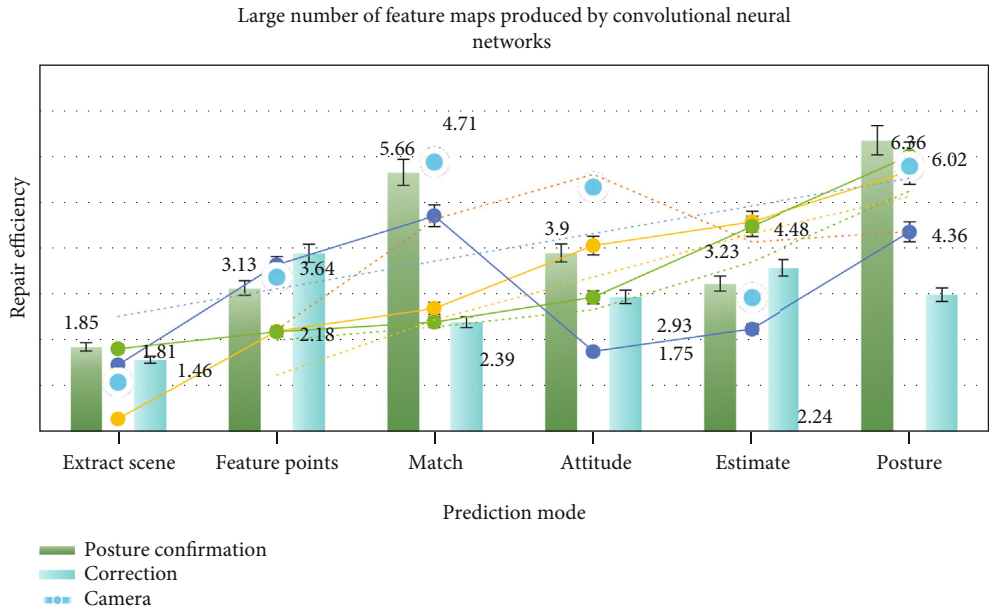

Figure 7: Large number of feature maps produced by convolutional neural networks.

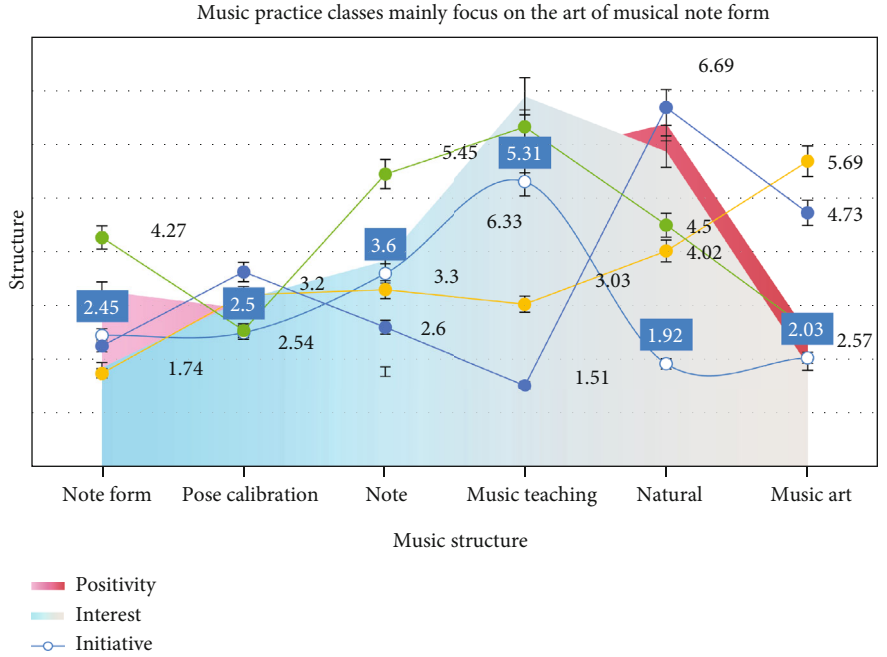

Figure 8: Music practice classes mainly focus on the art of musical note form.

Table 6: Traditional teaching methods are difficult to show abstract musical structure.

Item	Posture confirmation	Camera	Correction	Music art	Teaching	Precision
Extract scene	1.85	1.08	1.57	0.28	1.46	1.81
Feature points	3.13	3.38	3.89	2.19	3.64	2.18
Match	5.66	5.89	2.39	2.69	4.71	2.39
Attitude	3.9	5.34	2.94	4.06	1.75	2.93
Estimate	3.23	2.93	3.57	4.58	2.24	4.48
Posture	6.36	5.8	2.99	5.68	4.36	6.02

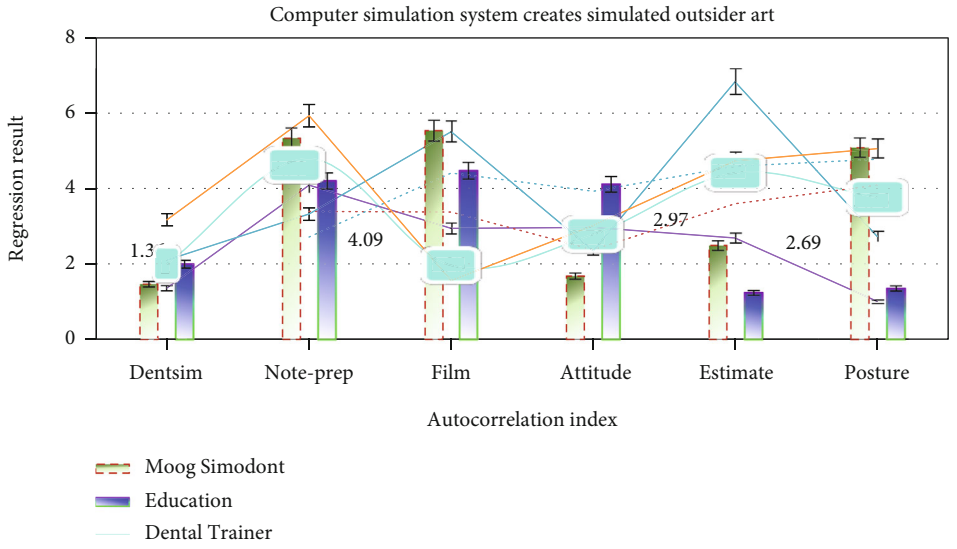

Figure 9: Computer simulation system creates simulated outside art.

Table 7: VR has been reported to be used to train classroom skills.

Item	Moog Simodont	Dental trainer	Education	Military	Music	Design
DentSim	1.47	2	2	1.36	2.1	3.17
Note-prep	5.33	4.79	4.2	4.09	3.32	5.93
Film	5.53	1.96	4.47	2.94	5.51	1.56
Attitude	1.68	2.78	4.11	2.97	2.35	3.02
Estimate	2.49	4.41	1.24	2.69	6.83	4.73
Posture	5.08	3.76	1.35	1	2.73	5.06

enter into an efficient learning state, thus undermining their learning enthusiasm, initiative, and interest and reducing their learning efficiency.

As shown in Table 6, traditional teaching methods are difficult to show abstract music structure. Music as a basic music course, its teaching content is rich, and its concept is abstract and obscure. At present, the commonly used music teaching methods, such as the Internet, 2D pictures (Atlas), and corpse music, have some limitations. For example, when explaining art music, students need to master many abstruse and abstract professional terms, music levels, and adjacent relationships in a short time. If 2D pictures are used for teaching, 3D spatial structure cannot be displayed directly; if specimens are used for teaching, although 3D structure is used, the relationship between music levels cannot be clearly presented.

As shown in Figure 9, computer simulation technology is involved in the creation of many external disciplines. VR has a wide range of applications, including film and television, education, military, music, design, and other fields. As shown in Table 7, VR has been reported to be used to train classroom skills, study human musicology, design surgical procedures, and treat patients with voice phobia. At present, a variety of VR systems have been applied in music teaching. Dentsim system, Moog Simodont, and dental trainer system can effectively help students master the basic methods of

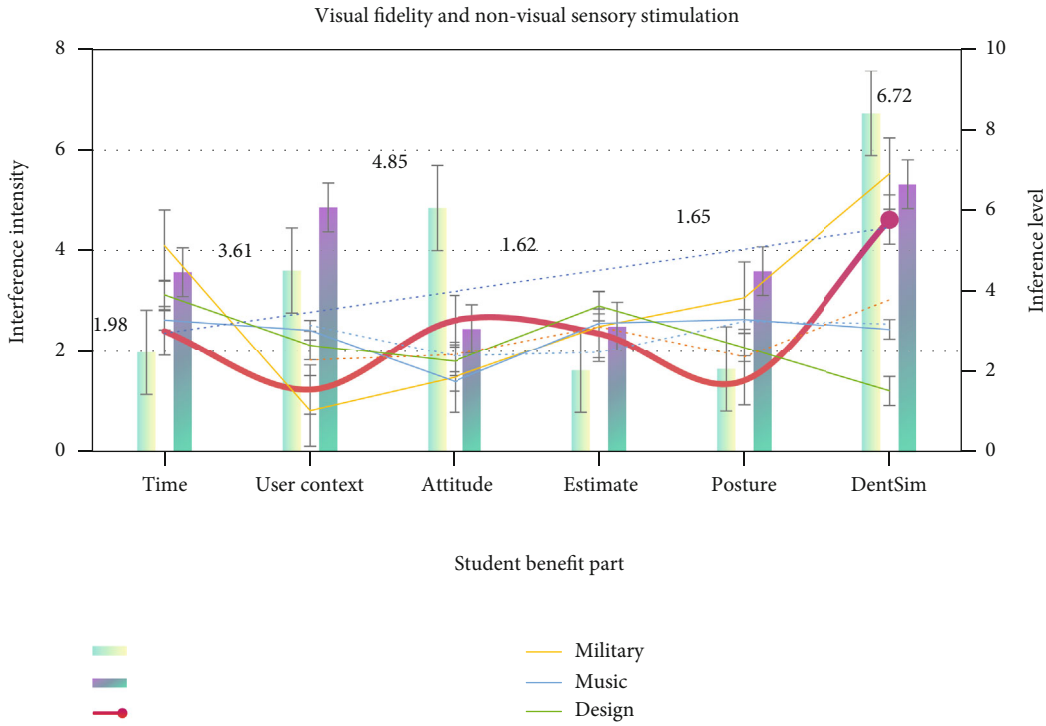

Figure 10: Visual fidelity and nonvisual sensory stimulation.

note preparation and actively improve the teaching quality of music professional courses.

As shown in Figure 10, virtual art created by VR can help users' episodic memory by adjusting students' visual fidelity and nonvisual sensory stimulation. Through data analysis, we know that VR and augmented reality teaching system can shorten the teaching time by 65%. Using VR technology to reconstruct music art can make students observe the form of music art intuitively. The combination of VR technology and traditional teaching methods can significantly increase students' learning initiative, interest, effectiveness, and participation; achieve better teaching effect; and make full preparation for the next classroom learning and practice. Training course is the most effective way to mobilize students' thinking in image. VR technology can be used to establish various virtual laboratories and carry out virtual training in them.

5. Conclusions

Music art teaching is closely related to art science. To some extent, its theoretical basis is the principle of artistic diversity. The metaphorical analogy between the diversity of music and the diversity of biology and art can be regarded as a pioneer in the study of music art teaching. In the study of music anthropology in Papua New Guinea, it is found that the artistic presentation of natural sound is the core expression of local folk music, and the sensitive experience of local residents on soundscape is completely through music to reflect the close relationship between nature and human culture. Sound anthropology is a branch of science that studies the close relationship between nature and human culture through music. Science is rigorous, and art is creativity. In vocal music teaching, we must not only adhere to the scientific nature, but also follow the artistic nature of vocal music, break through the purely technical concept of vocal music teaching, and realize the coordinated and unified development of science and art.

Music is the carrier of the world's national culture, and each nation has a unique way of thinking to form and inherit and nourish the national morality, religion, science and art, and other cultural genes. In ancient China, "music is to adjust the wind" and "music is to save the wind" are trying to express the expectation of good weather through music. Most of the world's folk songs are characterized by the artistic consciousness of integrating the beauty of landscape and natural landscape with regional style. This is the most common embodiment of the relationship between music and nature. Most of the masterpieces handed down from generation to generation are music works praising natural art. Different from the description of art by art science and art scholars, the lyric language of musicologists is discontinuous, metaphorical, and qualitative. Some music works are important evidence for the study of art history.

This paper believes that the Internet of Things technology is a comprehensive technology and a systematic project. At present, no institution or company in China can take full responsibility for the entire system planning and construction of the Internet of Things, but its theoretical research has been in all walks of life; the Internet of Things is only limited to the interior of certain industries in its practical application. Therefore, "virtual reality art Musicology" needs a definition that can clearly reflect its research scope. Based on this, we try to define it as "virtual reality art musicology"

which is based on the theory of musicology, by absorbing the theories and methods of art science and modern art science and studying the relationship and interaction between the formation of music culture, work creation, type characteristics, and function value and art.

Data Availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Conflicts of Interest

The author declares that they have no conflicts of interest.

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