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Research Article

Development and Analysis of Educational Virtual Reality System Using Static Image

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With the rapid improvement of computer hardware performance, the price of computer and its ancillary equipment is also reduced. Virtual reality technology is a method of simulating the real world through the use of computers. It can meet the needs of situational and natural learning media interaction; so, it has a huge application potential in the field of education. Life is altered by technological advancements. The advent of virtual reality technology has opened up new avenues for traditional education. Its inception allows for the advancement and innovation of traditional teaching tools. Simultaneously, as a new teaching aid, it plays an important role in piquing students' interest in learning and improving teaching effectiveness. In terms of simulation, it creates a three-dimensional world for users to interact with and reflect changes in physical objects in real time. Participants can get a sense of direct participation and exploration of the role and change of virtual objects in their environment by engaging in realistic perceptual behaviors such as viewing, listening, touching, and touching.

1. Introduction

With the rapid development of network technology and communication technology [1], web-based distance learning, as a new research field of educational technology, is rising day by day. Virtual reality has gradually stepped out of the laboratory and entered our daily life and learning. Now, it has been widely used in the fields of TV, film, and video games [2]. Virtual reality technology has attracted a lot of attention as a new type of educational media that provides new development ideas for modern distance education and thus develops and forms distance virtual teaching technology [3]. Only a few computer scientists should be able to master technology. The most advanced technology should not be prohibitively expensive but rather should be accessible to the general public and seamlessly integrated into our daily lives [4]. There are two types of distance education [5]. One is a real-time interactive system based on video conferencing technology that is a supplement to traditional teaching methods. The network-based remote multimedia teaching mode is another mode of implementation. Virtual distance education has evolved into a representative service industry [6]. The application of modern information technology and harmonious human-computer interaction technology is critical. At this time, the network-based education system has entered the era of personalized development, which necessitates that our educational system implement humanized interactive teaching and individualized teaching based on students' aptitudes, while also making intelligent adjustments based on learners' learning interests and emotions. Time and location restrictions can be removed from teaching activities [7]. Students can learn on the Internet at any time and from any location while receiving individualized and interactive instruction [8]. Students can choose their own learning content and pace, as well as communicate with teachers and classmates via the Internet, recognizing their subjective status [9]. Virtual reality technology can use a three-dimensional virtual environment to simultaneously eliminate the boundaries between time and space, and it will become a new cognitive tool. Once the new information technology [10, 11] has gained widespread acceptance, it will be adopted by various countries, cultures, and organizations for a variety of reasons. They can apply this technology to a wide range of

applications and practices, potentially affecting the rate of technological innovation, speeding up technological change, broadening the scope of technological change, and increasing the diversity of information resources.

When the network era first began, the connection between people and information was not as strong as it is now. The network's degree of promotion, technical capabilities, and level of use were all limited. Virtual reality technology is now being used in network teaching as a new media form, with the ability to virtualize teaching scenes, teaching experiments, and skill training, as well as use the benefits of virtual reality scenes such as interactivity, immersion, multi perception, and operability to express teaching contents, solve key and difficult problems in teaching, and fully mobilize learners' initiative and creativity. Encourage learners to actively construct their knowledge [12]. In fact, it is to use virtual reality technology to create a virtual learning environment, reproduce the living objective reality on which students' knowledge is based, teach the key points of knowledge, summarize the theory, guide students to make full use of their senses such as vision and hearing to receive information, stimulate students' learning interest and innovation consciousness, and inspire students to use their imagination to its full potential. There is a method of instructing students on how to engage in creative thinking activities [13]: teaching virtualization, student virtualization, and teaching resource virtualization are all aspects of a virtual teaching system. Allow students to learn in a more real-world setting, allowing them to improve their skills and gain knowledge while practicing the teaching concept of "teaching students according to their aptitude." Second, some novel classrooms, such as driving students to play games or showing videos, can improve students' intrinsic motivation, make the classroom more vibrant, provide students with opportunities for active exploration and learning, and greatly increase the proportion of students who are actively learning. It is necessary to create a harmonious man-machine environment that resembles the objective environment, transcends objective time and space, and can immerse itself in and control one of them, namely, the manipulable space composed of multidimensional information [14–16]. Distance education is now a reality, and technology has even changed the one-to-many mode of traditional classroom education, allowing for a many-to-many mode. Discussion among students and communication between students and teachers are possible in the many-to-many mode. I believe that, because of its strong teaching advantages and potential, the new distance education media will be given more and more attention and favor by workers and will be widely used in the field of education and shine brightly.

The network information society is promoting the reform of higher education step by step. The wall of the campus is gradually disappearing, students have less dependence on teachers, and classroom teaching has been severely tested. The new education mode of students studying in online virtual university has quietly arrived by establishing electronic classroom and electronic blackboard on the network. Science and technology is a double-edged sword, which has both advantages and disadvantages for teaching. The development of technology is too fast. Teachers need to understand it very quickly if they want to keep up with the pace of the times, but the cycle of upgrading is constantly shortening, which also brings a test to educators. Its pattern search and data sorting also have certain difficulties. These subjective and objective factors will affect the comprehensiveness and objectivity of the data. This paper makes an in-depth research and optimization on the development of educational virtualization for static images. Combine the advantages of the technology itself and give full play to its greatest advantages.

2. Literature Review

Virtual technology incorporates digital image processing, computer graphics, artificial intelligence, multimedia, sensors, parallel processing, and other technical means, according to literature [17]. These technologies are among the most recent advancements in the field of information technology. They not only provide essential nutrients for the birth and development of the virtual world but they also help to advance computer technology [18]. Literature computers were used to replace some people's positions in the classic experiment of studying human social relations. The results of human-machine experiments are the same as those of human experiments, according to the experiment [19]. Literature The network virtual reality technology, which uses the keyboard, mouse, monitor, and other traditional input and output devices to create an interactive environment in the client browser, has matured and perfected to this point. These technology-based network technologies also aim to simulate nature, providing fidelity and strong interaction, and to a large extent, and they have succeeded in achieving the system goal in a cost-effective and efficient manner. Literature [20] presents the reality of virtual things, reappearing, simulating, and fictional things, presenting abstract materials in a concrete and realistic manner, and transmitting clue information to the experiencer through multisensory channels, thus enhancing the sense of reality, weakening the user's feeling of using the computer, and making the experiencer feel as if he is directly communicating with the actual object. Virtual reality is usually thought to be primarily used in a subject dominated by computer graphics that allows people to be fully immersed, which requires a high-performance processor to solve. Literature [21] proposes the name network virtual reality, which is easy to mislead people to some extent because virtual reality is usually considered to be primarily used in a subject dominated by computer graphics that enables people to be fully immersed, which requires a high-performance processor to solve this problem. According to the literature [22], the main advantage of geometric model modeling and real-time dynamic display technology is the ability to change the observation point and direction at will. People began to wonder if it was possible to avoid the time-consuming modeling process and complicated drawing calculations by directly using images to achieve real-time modeling and dynamic display of complex environments. Modern education is explained in literature [23]. With the widespread

adoption of broadband technology, new virtual reality technology that is real, interactive, and plot-based will usher in a revolution in educational methods, allowing us to experience real-time, dynamic, and immersive environmental education in all directions [24]. Literature Virtual reality technology is a high-risk, high-reward science, and technology field. Although there is still a gap in China when compared to some developed countries, it has piqued the interest of scientists, governments, and relevant departments. In the literature [25], the characteristics and transmission modes of virtual reality technology are compared using an analysis and summary of the application of virtual reality technology in various fields, and then the problems and shortcomings are presented using an analysis of the current state of technology transmission, and knowledge in the teaching field is introduced. The communication process and situation are analyzed and studied in various ways by combining multidisciplinary knowledge such as activity theory, basic virtual reality technology research, and communication, and on this basis, exploratory strategies are proposed. Literature [26] introduces emotion into the field of educational dialogue, allowing teachers and students to communicate in a more natural and effective manner.

To sum up, it can be seen that scholars have studied virtual teaching from various aspects. At present, the development of this project has been greatly developed, but in every school, each teaching system is different; so, it is still difficult to implement it. The atmosphere of space education is also very important; so, the important problem now is to solve the difficulties in each school one by one through real data, so that teachers and students can have a relaxed class.

3. The Meaning and Basic Concepts of Static Images

3.1. Basic Concepts. Static image virtual reality technology is a very basic type of virtual reality technology. Its R&D and operation are straightforward, and the application equipment is widely available. As a result, it has gained popularity in the market. Its most important feature is that it can provide 360-degree panoramic views of an object or space [27]. We can surround a hall and observe it from any angle, or we can observe it around an object in a 360-degree range, using it to create a virtual scene. Currently, the most common Panoramic Map in our lives is the best example of using virtual reality technology based on static images to benefit humanity. It can be thought of as a cylindrical plane with a specific height centered on the node, onto which the scenery outside the plane is projected, forming the panoramic image. In comparison to other virtual reality technologies, virtual reality based on static images uses pictures, videos, or digital images to create a virtual environment, which gives it a high level of reliability and clarity. At the same time, it is less affected by network broadband and does not require high equipment fluency during operation due to the small amount of data and fast network download speed. Virtual reality technology based on static images can be viewed and browsed on any ordinary home computer [28]. It is capable of observing three-dimensional space and objects from every angle. It does not require any of the Virtual Reality Technology College's auxiliary equipment, such as helmets, special glasses, or gloves. It can be viewed directly with a mouse on mobile phones or computers [29]. Customers do not require a special server to enjoy the real virtual world. It paves the way for new ways to combine multimedia and simulation technology, and it makes a significant contribution to the popularization of "virtual reality" [30].

3.2. The Significance of Static Images for Virtual Reality Technology. At present, virtual reality technology based on static images is mainly used in natural sciences such as history, geology, nature, biology, and medical treatment, and some commercial projects have begun to explore its deep application in this field. For education, it has unique advantages in the display of three-dimensional space, the display of three-dimensional objects, the introduction of exhibits, the creation and construction of virtual space, and the construction of virtual scenes. For education, making full use of him is not only to improve the teaching effect of class but also to recommend the teaching reform and promote the continuous development of education in China. The virtual technical process is shown in Figure 1.

In teaching, he can provide more intuitive panoramic images for teaching. For students of history, geography, and architecture, he can cross the distance of time and space and bring three-dimensional scenes into it, which can make students feel the charm of private museums, see classic building models, and walk along ancient streets to immerse students. Facing engineering students, most of them use skill training. Students have boring classes, only written introduction and practical operation. Students can only face cold parts. However, if virtual technology is used, students can feel the analysis and resolution of parts and assembly, and form the image of equipment construction in their mind. When you start, you can operate faster and have the ability to quickly respond to emergencies. This can help students better master relevant knowledge, and the efficiency of learning will be significantly improved. The student system operation interface is shown in Figure 2.

Secondly, the cost of static image is relatively low, which saves the investment of teaching resources and funds. Compared with other servers, it can be reused and has stronger compatibility, and the later maintenance cost and R&D cost are also low, which is of great significance to the sustainable development of education. Moreover, three-dimensional auxiliary means also reduce the pressure on teachers. Relying on teachers' oral explanation or picture display alone cannot well improve the classroom effect and activate the classroom atmosphere. With virtual still image technology, teachers can directly show the three-dimensional influence to students, and many problems can be solved.

3.3. Based on Independent Component Analysis. Independent component analysis (ICA) takes n original images as a linear combination of m characteristic images and then performs independent component analysis on this characteristic image. Feature images are obtained by principal

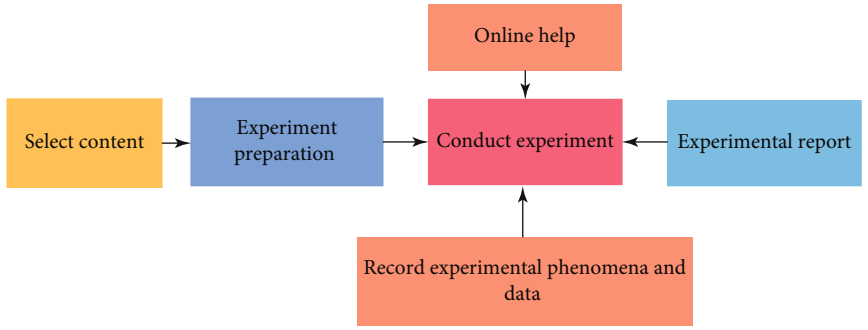

Figure 1: Virtual technology process.

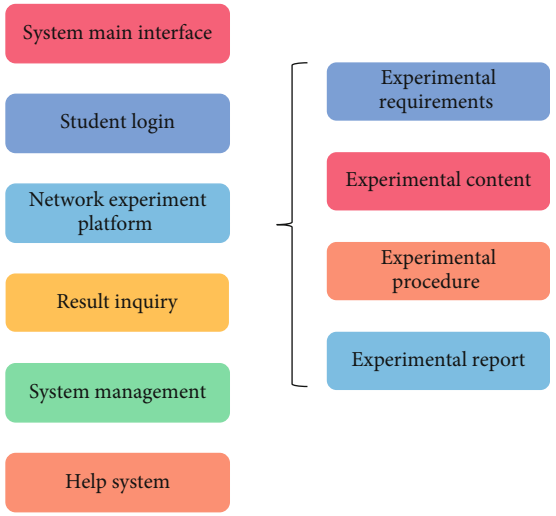

Figure 2: System operation interface diagram.

component analysis. This method has great application potential in many fields of signal processing and has attracted extensive attention in the field of international signal processing. The ICA linear model is shown in Figure 3.

This is a new blind source separation method developed this year. ICA problem is linear mixing and separation model. $S = (s_1, s_2, \cdots, s_N)^T$ and linear mixing matrix A are unknown. W is the separation matrix to be solved $U = (u_1, u_2, \cdots, u_N)^T$. ICA is the final output result. Only the observation signal vector $X = (x_1, x_2, \cdots, x_M)^T$ is known, in which each component $x_1 (i = 1, 2, \cdots, M)$ has the same observation sample length. M and n, respectively, represent the number of observation signals.

It is assumed that M observation signals x_i are linear combinations of N unknown source signals s_j, the value of $M > N$ is zero, and the components are not independent of each other. When the observation noise is not considered, the formula is as follows:

$$x_i = \sum_{j=1}^{N} a_{ij} s_j, i = 1, 2, \cdots, M. \quad (1)$$

Matrix form is

$$X = (x_1, x_1, \cdots, M)^T = A(s_1, s_2, \cdots, s_N)^T = A \cdot S. \quad (2)$$

X, A, and S represent the observation vector, the mixing matrix, and the source signal vector, respectively. Particularly, a is m^*n matrix.

In order to recover the source signal from the mixed signal, a simple linear separation system can be adopted, and the formula is as follows.

$$U = (u_1, u_2, \cdots, u_N)^T = A(s_1, s_2, \cdots, s_M) = W \cdot X, \quad (3)$$

where U, W, and X represent separation signal, separation matrix, and observation vector, respectively, W is M^*N separation matrix, and A and W are specifically expressed as follows:

$$A = \begin{bmatrix} a_{11} & \cdots & a_{1N} \\ \vdots & \vdots & \vdots \\ a_{M1} & \cdots & a_{MN} \end{bmatrix} = [a_1, \cdots, a_N]^T, \quad (4)$$

$$W = \begin{bmatrix} w_{11} & \cdots & w_{1N} \\ \vdots & \vdots & \vdots \\ w_{N1} & \cdots & w_{NM} \end{bmatrix} = [w_1, \cdots, w_M]^T. \quad (5)$$

There are numerous applications for expression calculation, just as there are for ICA. It is to find a linear transformation for non-Gaussian data that results in statistically independent or as independent output components as possible. Everything is in a different place. As a result, the criterion for judging independence is critical. Because mathematical independence is the same as Gaussian, he only needs to consider two criteria: negative degree and kurtosis. The former is commonly used to determine whether two variables are independent due to the latter's inaccuracy. The non-Gaussian property can be measured using an approximate formula. The following is the formula.

$$J_G(\mathrm{y}) \approx \sum_{i=1}^{P} k_i [E\{G_i(y)\} - \{G_i(v)\}]^2 \quad (6)$$

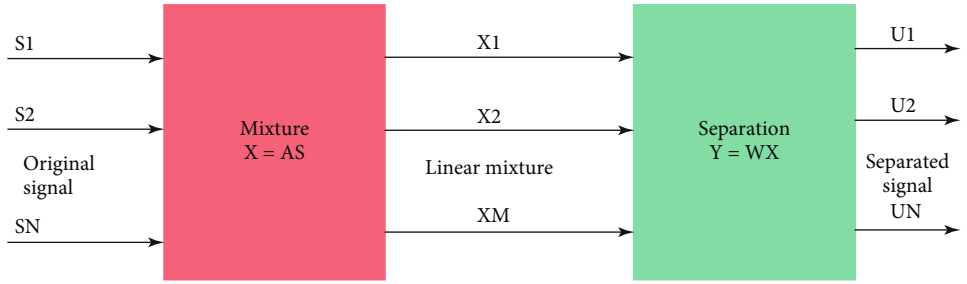

Figure 3: ICA linear model.

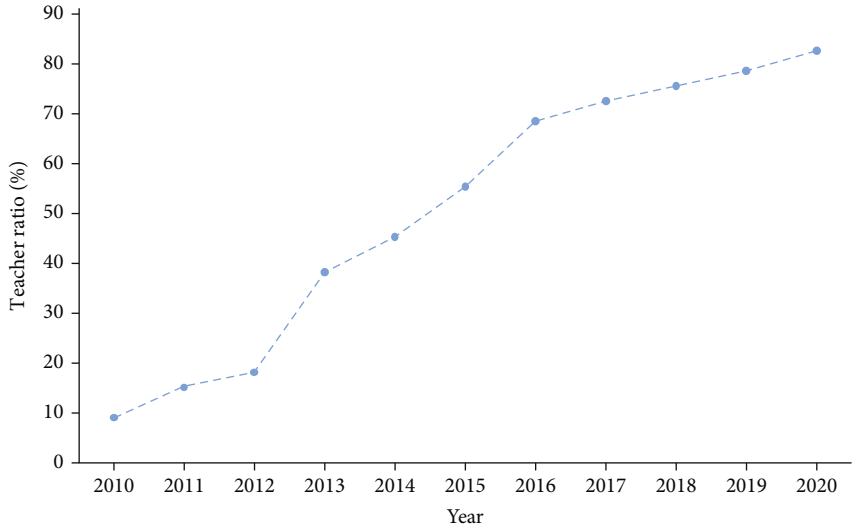

Figure 4: Growth trend of virtual technology.

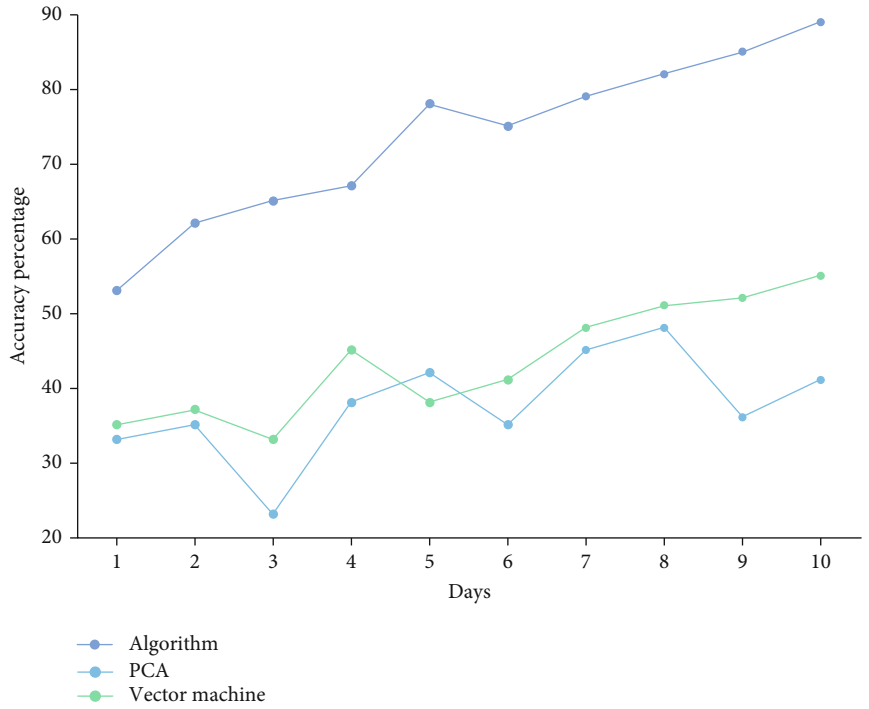

Figure 5: Compares the algorithm, PCA, and vector machine methods in this paper.

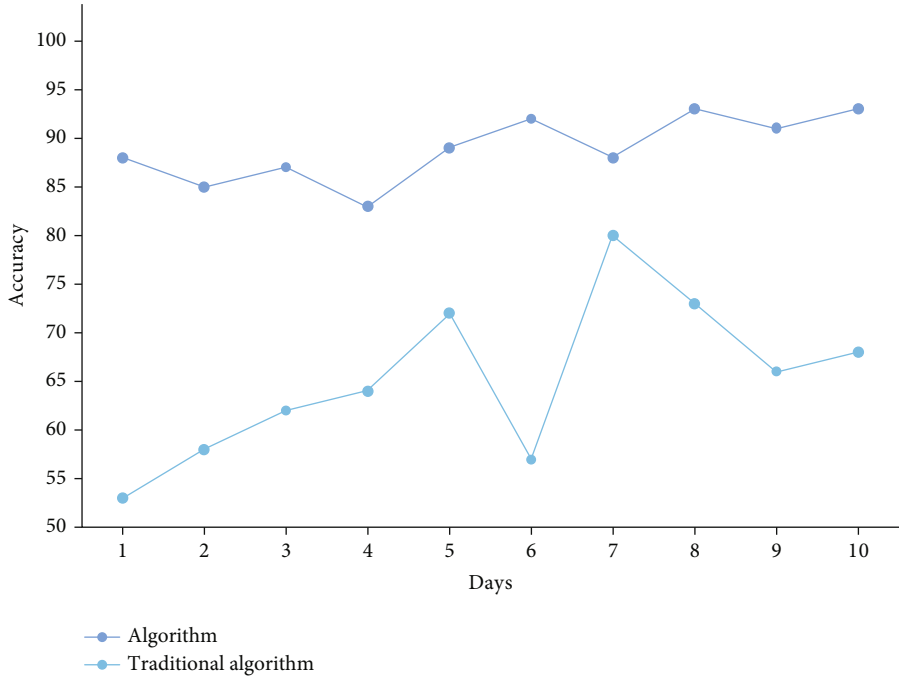

Figure 6: Comparison between this algorithm and traditional algorithm.

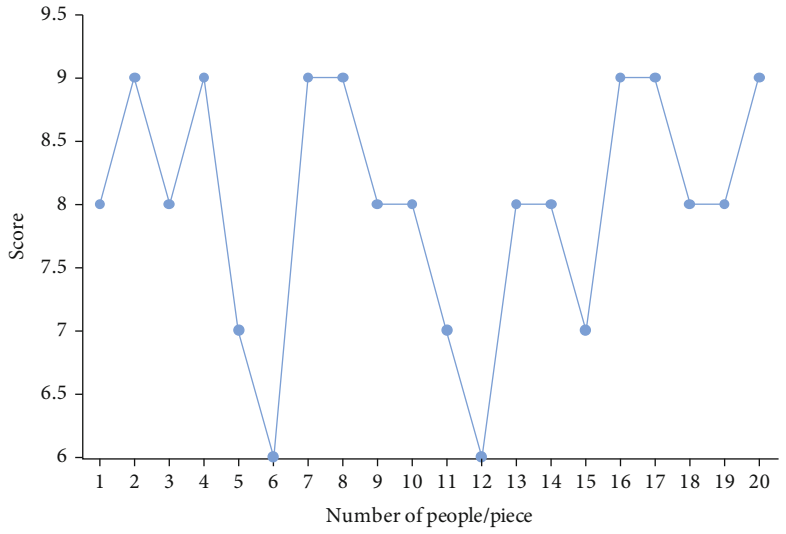

Figure 7: Acceptance ability of 20 teachers.

Only one independent component is estimated in the equation above, and let the number of independent components be n. In order to estimate these n independent components, in order to prevent different full vectors from converging to the same extreme point, this paper will use the extraction algorithm based on Gram-Schmidt correlation. The formula is as follows.

$$w_{p+1}(k+1) = w_{p+1}(k+1) - \sum_{j=1}^{p} w_{p+1}(k+1)w_j, \quad (7)$$

$$w_{p+1}(k+1) = w_{p+1}(k+1)/\sqrt{w_{p+1}(k+1)^T w_{p+1}(k+1)}. \quad (8)$$

Generally speaking, this algorithm mainly has the following characteristics: by repeatedly running two algorithms with different expressions, we can get those real and excellent independent components with high probability, which has a great influence on the subsequent recognition stage. Compared with traditional algorithms, the features to be selected in this paper are features; so, the dimension of feature space is greatly reduced without losing a lot of

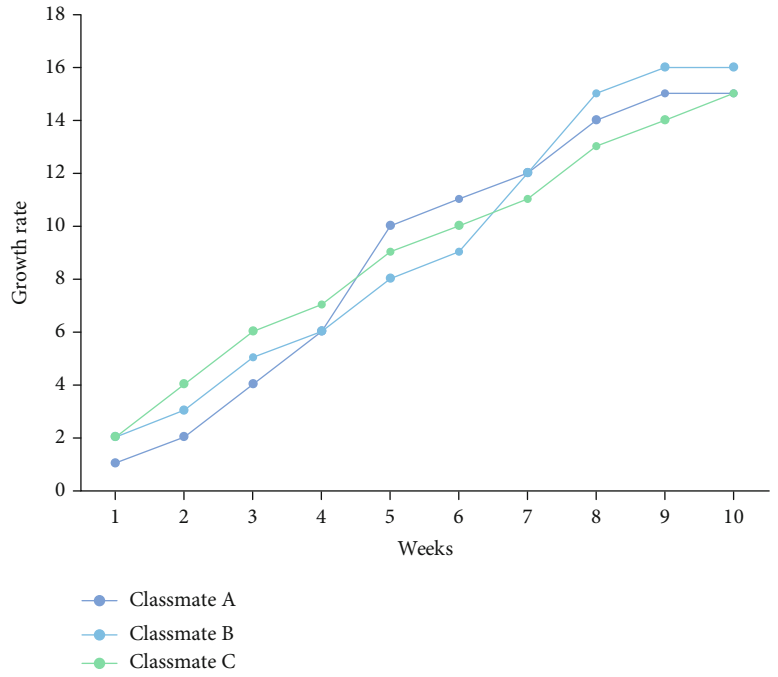

Figure 8: Growth of academic achievements of 3 students.

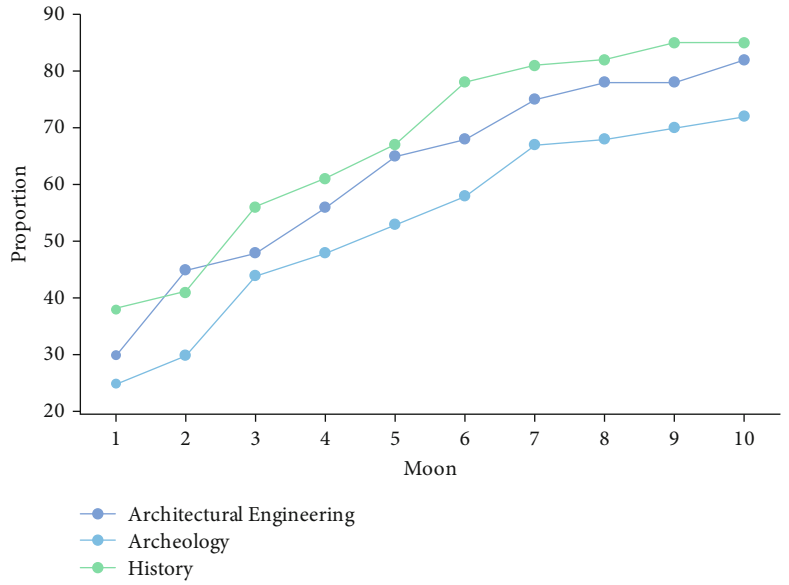

Figure 9: Trends in the three disciplines.

information; so, the execution efficiency is higher, and the recognition result is more accurate.

4. Experimental Measurement

With the rapid development of science and technology, new methods and models of new media education continue to emerge. There is a qualitative difference between active interaction and passive viewing. Experts in the field of education pointed out that new technology will bring us new educational thinking, solve the problems we could not solve before, and bring a series of major changes to our education. First of all, based on the current situation of still images, what is the existence of current education? From 2010 to 2019, we conducted a questionnaire survey on 15 teachers with 15 years of teaching experience. What is the application of virtual reality technology in the field of education? The growth trend of virtual technology is shown in Figure 4.

As can be seen from Figure 4, the data from the beginning of 2010 is still in the preliminary stage. Many schools have carried out virtual reality technology projects in response to the requirements of modern education. The data trend has not increased significantly, and the data has started to grow steadily in the mid-term. It can be seen that teachers

and schools are increasingly recognizing virtual reality technology and more and more put into use, and the growth rate in the later period is faster than that in the earlier period. The formula of the independent algorithm and the main methods of practical application are described in detail above. The algorithm, PCA, and vector machine methods in this paper are compared, as shown in Figure 5.

It can be seen from Figure 5 that the algorithm in this paper has obvious advantages compared with the other two algorithms. The main reason is the effectiveness of the algorithm in feature extraction, reducing the feature dimension of the traditional algorithm and improving the calculation efficiency. The recognition rate of the particularity of things is high. This is reflected faster than the other two methods. Compared with the traditional algorithm, the algorithm proposed in this paper is more multifaceted and locks data faster than the traditional method. The comparison between this algorithm and the traditional algorithm is shown in Figure 6.

The trend in Figure 6 is obvious, and the traditional algorithm's data integration comprehensiveness is far less than that of the independent algorithm in this paper. The algorithm used in this paper can distinguish between features with good discriminant analysis performance and those with poor discriminant analysis performance. Participants can thus take control of the experience's flow and order, as well as select the links they need while skipping the ones they do not. This allows us to effectively sense the process of consolidating students' learning knowledge and assist students in resolving knowledge difficulties. Static images are rapidly evolving, with the ability to directly embody the knowledge needed in textbooks in three dimensions, but how well do teachers accept them? As a result, a questionnaire survey of 20 senior high school teachers was conducted to determine what kind of attitude teachers have toward static images, how they treat static images, and how adaptable they are. Figure 7 depicts the acceptance ability of 20 teachers.

It can be seen from Figure 7 that most of the teachers still recognize the static image virtual technology. The teachers' scores for this technology are above 7, and only a small number of people are below 7. Most teachers agree with static images, and it can be seen from the questionnaire that teachers also have a lot of applications of this technology. Traditional communication media, such as print media, television, and telephone, eliminate the boundaries of time and space, while the interactivity generated by the role-playing of virtual avatar breaks through the boundaries brought by identity, so that users can use non personalized media to exchange personalized content. From the perspective of constructivist learning theory, using the openness to identity in virtual avatars can promote learning. We did research on the performance growth of each subject of the three students. The growth of the three students' academic achievements is shown in Figure 8.

It can be seen from Figure 8 that static images play a positive role in students' learning in the field of education. The scores of the three students are increasing every week. The boring history and politics discipline can use image technology to show students the real historical environment and combine students' imagination with the development of electronic technology and can better integrate into the current classroom. It makes up for the defects of the traditional classroom, so that students can only learn from books and become learning from real images, which will not only deepen students' imagination but also enhance students' memory ability.

At the end of the experiment, the test investigates the effect trend of the use of virtual reality technology in three disciplines: architectural engineering, archaeology, and history education. From the perspective of current teaching organization, the multimedia primary school model is from the school model to learning centered, and the educated have a certain degree of freedom. However, the existing multimedia teaching model at this stage can only be regarded as an appendage of the traditional teaching model, and its poor interactivity limits the development of learners' potential. But now, the virtual teaching mode has the communication between man and machine and the communication between images, can use their own senses to receive and process all kinds of information, and process it into the understanding of objective things. The trends of the three disciplines are shown in Figure 9.

It can be seen from Figure 9 that in the ten months of the test, the utilization rate of the disciplines has been increasing, and the archaeology will have a slight impact, but the gap is not large, and each discipline has its own scope of application.

5. Conclusion

Virtual reality's development in the field of education has been actively investigated both domestically and internationally. In China, research into the use of virtual reality technology in education is still in its early stages, with little in-depth research. Virtual reality technology has injected new vitality into it and brought more possibilities to upgrade and improve traditional teaching methods, whether through the development of new teaching tools or the improvement of teaching methods and effects. Virtual reality's application forms in network distance teaching will diversify and become more widely used as the technology develops and improves. Distance virtual teaching, as an important component of modern distance education, takes full advantage of the learning environment provided by modern information technology, including new communication mechanisms and a wealth of resources, giving modern distance education a whole new meaning. Many specific issues surrounding the use of virtual reality technology in distance education, particularly in experiments, still require further discussion and research. This paper looked into the development of educational virtual technology and conducted research on it. Although domestic technology is still in its infancy in comparison to that of other countries, it has been bolstered by a large number of eager learners. As a result, the virtual reality system has improved steadily, and classroom instruction has fully mobilized children's enthusiasm. There are numerous flaws in this article's research that will be investigated further in the future.

Data Availability

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

Conflicts of Interest

The author does not have any possible conflicts of interest.

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