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Research Article

Construction of Virtual Reality-Interactive Classroom Based on Deep Learning Algorithm

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The traditional classroom has been impacted by the digital teaching resources. Students are no longer satisfied with the traditional teaching mode of teacher teaching and student learning. Combined with the characteristics of a virtual reality-interactive classroom, the design of a virtual reality-interactive classroom based on the deep learning algorithm is proposed. This paper divides the teaching activities of the VR-interactive classroom into two parts: in-class learning activities and after-class learning activities. The software is used to design the interactive test. The emphasis and difficulty in the virtual reality-interactive classroom are taken as the development object to realize the construction of the virtual reality-interactive classroom. The simulation results show that the statistical output of teaching quality evaluation can be obtained from the quantitative regression analysis of the factors involved in VR classroom participation.

1. Introduction

The construction of education informationization and the construction of digital teaching resources have made vigorous development. Since the mid-1990s, there has been an upsurge in the construction of teaching resources, especially in the field of basic education, with the emergence of a number of providers of digital teaching resources [1]. At the same time, it accelerates the construction of network video courses, greatly promotes the cultivation and construction of the teaching team, promotes the diversification of teaching methods and the quality of teaching resources, and effectively improves the ability and consciousness of university teachers to carry out teaching activities under the background of information technology [2].

In the reform of higher education, an innovative educational environment is the focus of this reform. While developing a modern teaching environment, colleges and universities should also use modern educational technology to improve the teaching level [3]. Most schools still retain the traditional (lecture-demonstration-practice) teaching model because of the limited time available in the classroom, which is difficult for students to grasp if too many points of knowledge are given in detail and difficult for students to understand if spoken in a cursory manner. However, interactive classrooms are concerned with slippage between teachers and students, student-student interaction, and individualized, resource-based learning and autonomous inquiry [4]. Therefore, it has become an urgent task to develop interactive classroom teaching.

Scholars have done a lot of research on this. The method of reference suggests a new educational platform in the classroom [5]. The ready-to-use availability of interactive platforms has created a new generation of students who can easily and comfortably use computer-based learning tools. The potential lecture materials for better "self-exploration" allow students to have an enhanced learning experience and stimulate them to tinker with equation parameters to produce insightful graphics or animations. In the classroom, it encourages students to have a deeper understanding of complex deductions or mathematical expressions. Experience is gained in implementing these materials in undergraduate and postgraduate courses, including examples of student feedback and supplementary homework used in the class. The method of Reference [6] suggests that flipping the classroom is an active teaching strategy that makes the curriculum more interactive and challenging. Based on the above methods, a virtual reality-interactive classroom based on the deep learning algorithm is proposed. The interactive function is added in the design of the virtual reality-interactive classroom. This method can effectively improve the practicability of interactive classroom resources and provide reference for the development of a virtual reality-interactive classroom.

The rest of this paper is organized as follows. Section 2 discusses front-end analysis of virtual reality-interactive classroom design, followed by a virtual reality-interactive classroom based on deep learning algorithm which is discussed in Section 3. Design of learning content in interactive classroom is discussed in Section 4. Section 5 shows the simulation experimental results, and Section 6 concludes the paper with the summary and future research directions.

2. Front-End Analysis of Virtual Reality-Interactive Classroom Design

2.1. Analysis of Learning Needs. The demand analysis is from the virtual reality-interactive classroom characteristic and is the individualized way of study of two aspects that carry on the analysis explanation. First, practical and operational courses such as virtual reality-interactive classrooms require interactive learning, and interaction does not refer solely to the presentation of learning content in video format [7]. Second, personalized learning has complied with today's learning trend and pays attention to learning efficiency and learning effect [8]. An interactive classroom can not only meet the characteristics of virtual reality interaction but also enable learners to study according to their own learning situation targeted to meet the learners' individual learning needs.

2.2. Learner Analysis. In the learner analysis stage, a questionnaire survey is conducted among the students in the upcoming virtual reality-interactive class to understand their learning needs and interests and attitudes in using interactive microvideos.

Most students have plenty of time to surf the Internet, but most of them do not make full use of the advantage of the Internet to study because of the lack of relevant learning resources, lack of enthusiasm, and low self-control ability [9]. Therefore, it is necessary to develop a set of video learning resources with learning tasks to assist the teaching of the virtual reality-interactive classroom and effectively improve students' autonomous learning ability [10]. According to the deep learning algorithm, the evaluation model of interactive classroom learning effectiveness is as follows:

$$L = C - m \times \sigma_s - \frac{(x_{st} - r_t)^2}{2\sigma_s^2}, \tag{1}$$

in which σ_s represents the learning efficiency of college students in the virtual reality-interactive classroom and m represents the implicit state of the evaluation model of learning effectiveness in interactive classroom. x_{st} is the space state of the model, r_t is the blocking state of the model, C is the optimal running state of the model, and σ_s is the observation state of the evaluation model of the effectiveness of interactive classroom learning.

An information flow model based on a differential equation is constructed to express the effectiveness of interactive classroom learning:

$$x_n = m(t_0 + \Delta t) \times L, \tag{2}$$

where t_0 represents the statistical characteristic state function of learning effectiveness in the interactive classroom and constructs the multivariate quantitative value function of the survey regression analysis sequence of learning effectiveness evaluation and L represents the measurement error.

The expression of the elastic grey model for evaluating the effectiveness of interactive classroom learning is as follows:

$$F(z) = \frac{dz(t)}{x_n}, \tag{3}$$

where $dz(t)$ is the best game state parameter of learning effectiveness in the interactive classroom.

If $dz(t) = \{i_1, i_2, i_3\}$, the total characteristic distribution satisfies $i \in I$, and then, the total gain rate $s_i = (x_1, x_2, \cdots, x_n)$ under interactive classroom learning satisfies the following:

$$f(x_1) = f(x_2) = \cdots = f(x_n) = f^*. \tag{4}$$

2.3. Analysis of Curriculum Objectives. In this study, the curriculum standards of the virtual reality-interactive classroom are analyzed, and the three-dimensional objectives of the virtual reality-interactive classroom are summarized as follows.

2.3.1. Knowledge and Skills. The knowledge and skills are as follows: to understand and master the basic theory and common sense of virtual reality-interactive classroom software, to master the use skills of the software, to master the operation interface and function of the software, to master the creative design of software use, and to cultivate students' autonomous learning ability.

2.3.2. Process and Method. The process and method are as follows: can use virtual reality-interactive classroom software to complete and create a work independently, master the basic methods and skills of image synthesis, and cultivate learning methods of active exploration and innovation in software learning [11].

2.3.3. Emotional Attitudes and Values. The emotional attitudes and values are as follows: to cultivate students' sense of teamwork, initiative of learning, innovative consciousness and spirit, and artistic accomplishment of students.

Based on this goal, this paper designs an interactive test function, which aims at enabling the students to master the knowledge and skills more firmly. Space reconstruction trajectory is as follows:

$$X = \left(x_n, x_{n-\tau}, \cdots, x_{n-(m-1)\tau}\right), \tag{5}$$

where x_n is the orthogonal eigenvector of regression analysis sequence of statistical survey on learning effectiveness of the interactive classroom, τ is the sampling delay of statistical characteristics of interactive classroom learning effectiveness, m is the embedding dimension, and $x_{i+(m-1)\tau}$ is a set of scalar sampling sequences.

Process and methods emphasize the comprehensive use of knowledge points, mainly through the setting of classroom tasks to help students meet the corresponding requirements. Emotional attitude and values emphasize the importance of students' autonomous learning, collaborative learning, and innovative learning. In this paper, in order to cultivate students' emotional attitudes and values, the interactive classroom teaching mode will be used to teach this course.

3. Virtual Reality-Interactive Classroom Based on Deep Learning Algorithm

The design of interactive teaching activities based on the deep learning algorithm can not only meet the needs of individualized learning but also help teachers to carry out teaching activities smoothly. Based on the characteristics of the virtual reality-interactive classroom, virtual reality-interactive classroom teaching activities are divided into in-class learning activities and after-class learning activities [12].

3.1. Design of Learning Activities in Class. Interactive classrooms are widely used in modern teaching, so classroom teaching activities include not only in class but also before and after classes. In the traditional teaching process, knowledge is imparted in class, and knowledge internalization is carried out outside class. When learners encounter problems and need teachers' guidance, the teachers are not present. On the one hand, the students' learning effect is not ideal, and on the other hand, the students' learning enthusiasm is reduced [13]. This paper makes use of the current interactive teaching mode to make up for the deficiency of the traditional teaching mode. Based on the model of explanatory variables and the model of control variables in the evaluation of learning effectiveness, the statistical feature extraction is carried out according to the distribution characteristics, association coefficient, average mutual information entropy, learning mode, and other constraint parameters of the deep learning algorithm resources, and the linear superposition output of a large number of statistical feature sequences of learning effectiveness in the virtual reality-interactive classroom is obtained:

$$r(i,h) = t(i,h) + w(i,h), \tag{6}$$

in which $t(i,h)$ represents the amount of virtual reality-interactive classroom data and $w(i,h)$ represents the number of virtual reality-interactive classes.

And teachers can design plans and assign tasks according to the characteristics of students. Through this teaching method, on the one hand, teachers can understand the learning effect of students' autonomous learning, and on the other hand, they can help students communicate and deepen the internalization of knowledge [14]. Then, according to the students' learning situation, make specific arrangements for different learning states. During the course of operation, students complete relevant tasks by themselves and solve problems by the BB platform, group communication, or watching an interactive class. Learning activities in class are shown in Figure 1.

3.2. Design of Learning Activities after Class. Postclass learning activities mainly include two links of preclass and after class. And these two links if attached to the BB platform of the deep learning algorithm help the students' personalized learning. The design of extracurricular learning activities is mainly a process of knowledge transfer using the SPOC environment. The design of learning activities based on the deep learning algorithm should make full use of the existing microcourses to carry out teaching activities. However, the missing teaching activities in the deep learning algorithm can be supplemented by the interactive classroom teaching mode. Since the learning of the interactive classroom is mainly aimed at learners with different majors and different degrees of mastery of the virtual reality-interactive classroom, they can use the time and place after class to choose suitable learning content for their own personalized learning [15]. Combining with the deep learning algorithm, the optimal outputs of the virtual reality-interactive classroom learning effectiveness evaluation and feature extraction are as follows:

$$r(i,h)' = t(i,h)' + w(i,h)', \tag{7}$$

in which $w(i,h)$ represents the derivative of data quantity of the virtual reality-interactive classroom and $w(i,h)$ represents the quantity derivative of virtual reality-interactive classroom.

Based on the analysis of learners' needs and the applicability of courses, the design of preclass learning activities divides the curriculum objectives into small independent objectives and integrates the interactive classroom and high-quality teaching methods into a complete SPOC learning environment [16]. Through the function of interactive test and timely feedback, learners can make up for the deficiencies before class and achieve key problem and key study. Before class, the teacher's task is heavy; the teacher needs to develop the corresponding interactive class according to the course front-end analysis and put it on the BB platform for the learner to study [17, 18], and collect the learner's questions in the discussion class, so that timely feedback is in class. Preclass learning activities are structured as shown in Figure 2 [19].

After class, it is a process of reviewing and consolidating learning. This process is mainly to check the learner's grasp of knowledge through independent learning, to sum up the questions put forward by everyone in class, and to adjust and correct them in time before class and during class [20, 21]. To evaluate students' scores after class, the first step is

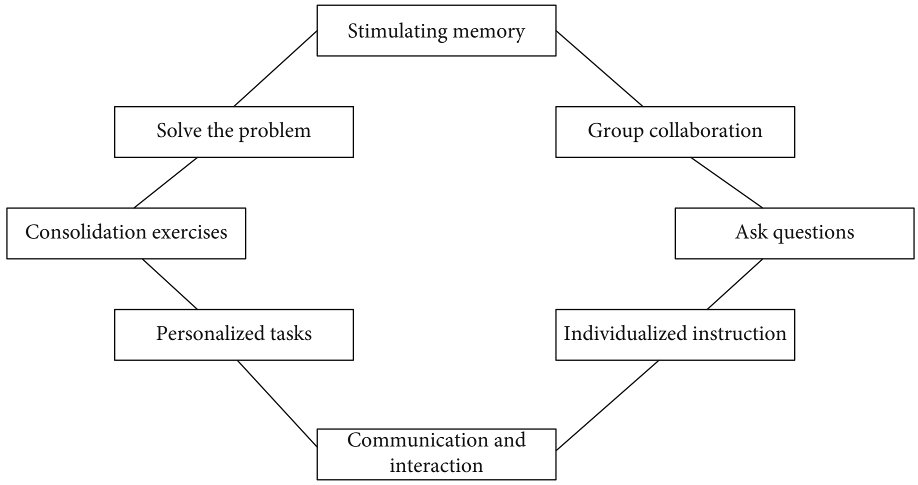

Figure 1: Learning activities in class.

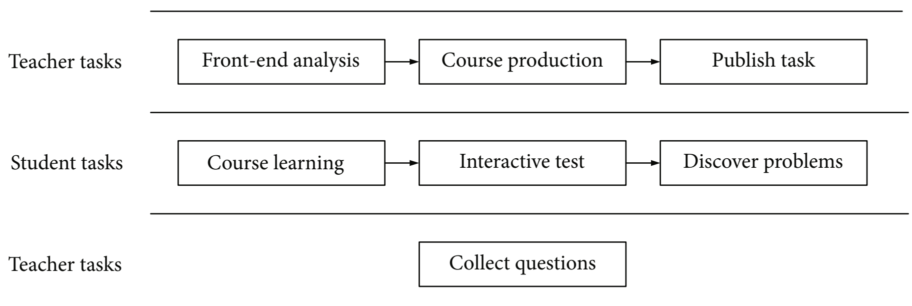

Figure 2: Prelesson activities.

to obtain the students' historical scores. The calculation formula is as follows [22]:

$$H = G_m \times \frac{f}{d \times k}, \tag{8}$$

in which H represents the final test scores of previous semesters, G_m represents the student information, d represents the students' current scores, k represents the students' learning progress, and f represents the difficulty of examination contents.

On this basis, the evaluation criteria are set, and the calculation formula is as follows [23]:

$$D = \frac{B_i}{r/H}, \tag{9}$$

in which B_i represents the student grade evaluation parameter, r represents the student examination information, and D represents the learning evaluation parameter. After-class learning activities are shown in Figure 3 [24].

4. Design of Learning Content in Interactive Classroom

Because the virtual reality-interactive classroom is mainly about practical operation, the design of interactive classroom learning content includes not only microvideo but also learning objectives, video summary, and interactive tests. As shown in Figure 3, virtual reality-interactive classroom learning starts from learning objectives, through which learners can clearly know the skills and learning process required for the course learning. In order to facilitate different levels for students to choose suitable learning content, highlighting the requirements of personalized learning is needed. The second is to watch the video to learn; through the teacher's demonstration and explanation, learners can carry out the corresponding observation and reflection. And the icons, questions, subtitles, etc. in the video are all interactive. Third, students according to the video summary of the teacher targeted combing the content, conducive to the consolidation of classroom knowledge. Finally, an interactive test is used to test the learner's mastery of the knowledge point.

4.1. Learning Goal Design. Learning goal is the starting point and end result of teaching activities. Therefore, the learning goal should be described clearly and concretely before teaching. This is the standard which the study activity must achieve and is anticipating the student study result. It fundamentally restricts the direction of instructional design and plays a guiding role in the teaching process, thus effectively avoiding the blindness of teaching.

The design of learning objectives pays more attention to let learners know the purpose of learning, lead learners, and

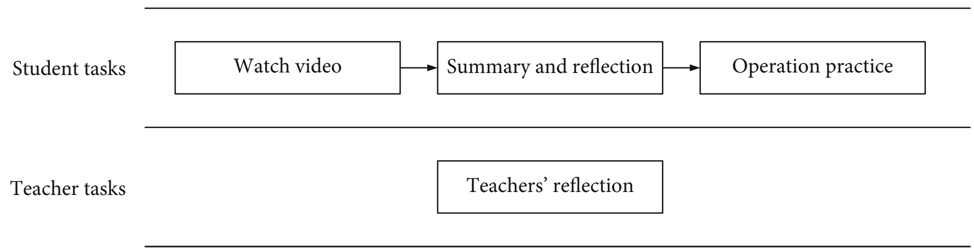

Figure 3: After-school activities.

stimulate learning motivation. The learning objectives of the virtual reality-interactive classroom are mainly realized through virtual reality-interactive classroom software. Teachers do not explain learning objectives too much but let learners understand the knowledge points in this section and the framework structure of the whole knowledge points through learning objectives.

4.2. Video Content Design. The design of course content mainly includes four basic links: "script writing," "material collection," "component development," and "content integration." In terms of importance and implementation difficulty, "scripting" and "component development" are two of the most noteworthy aspects.

Based on the structure of the courseware, "script compiling" is to further consider and arrange the courseware content, layout, audio-visual forms, and the writing of commentary. Script editing can be said to be one of the key links that directly affect the development of courseware. It can lay a solid foundation for the follow-up work to study and write carefully.

When the script is finished, enter the "material collection" link. This link is the starting point and symbol of the development of the interactive class. Teachers really start to make courseware—prepare various materials for the courseware. According to the characteristics of the virtual reality-interactive classroom, the interactive classroom materials mainly include text and pictures.

In order to guarantee the originality or uniqueness of the material, most teachers design and make the material by themselves from beginning to end. Not only did this increase the burden of teacher development, but also the quality of the material makes it difficult to achieve the desired results. Therefore, we need to find another way of thinking: to make full use of the principles of fair use in copyright law and the use of vast resources on the network, that is, to make use of existing materials on the network to meet the needs of their own courseware development, rather than a hands-on over-emphasis on the so-called originality.

The so-called "component development" is actually a superordinate concept of material. When several materials are related to a set in some way, it constitutes a component. In other words, a component is a structured representation of the material. Furthermore, based on a certain structure or relationship, a courseware is constituted after the components are interrelated with each other. With the courseware, teachers need to use screen video experts to record PS operation. In the recording process, teachers are both teachers and video producers. Therefore, teachers should be accurate and logical when explaining so that the compilation is clear. In the recording process, pictures of intellectual errors or misleading descriptions are not allowed to appear in the language. And in the recording process, teachers' must pay attention that it is not too long, generally 5-10 minutes only. Also, attention must be paid on the use of the mouse in the process of explanation. When watching the video demonstration, the students' attention is on the mouse, so the teacher should remember not to shake the mouse randomly during the operation.

4.3. Video Summary Design. The summary is an indispensable link in the process of video teaching. At the end of the course, students' attention is easily distracted. The teacher can design a skillful classroom summary, not only to consolidate knowledge and improve interest but also to further stimulate students' thirst for knowledge, to achieve the "although the end of the class, interest is still" realm.

The summary is classified according to the content, subject, and carrier, as shown in Table 1. In the design of the microvideo summary, knowledge structure summary, problem summary, and teacher summary are mainly used. The method adopted in the design of the summary is consistent with the learning objectives, that is, it is achieved by using the virtual reality interactive classroom software. The specific design structure is shown in Figure 4.

After explaining the relevant virtual reality-interactive classroom knowledge points, the teacher summarizes all the operation steps and precautions in this section, which plays a strengthening role for students. Moreover, the teacher introduces the scope and conditions of the tool through examples, which can expand students' thinking and enhance their innovation and creativity. Finally, the teacher will arrange the relevant contact to help students consolidate their knowledge and achieve the purpose of the skilled operation.

4.4. Interactive Test Design. The interactive test is the last module of interactive learning in the virtual reality classroom. It is mainly used to test the previous courses, which can help students to further consolidate their learning knowledge. Not only can it let the student understand the situation to grasp this section's microlesson, but also it can help the student to check the loophole to make up for the deficiency. Because of the different levels of learners in the virtual

Table 1: Summary classification.

Division basis	Type
Content	Knowledge structure summary, learning method summary, thinking concept summary, learning situation summary, problem summary
Subject	Teacher summary, student summary, teacher-student interaction
Carrier	Blackboard, multimedia courseware, notes

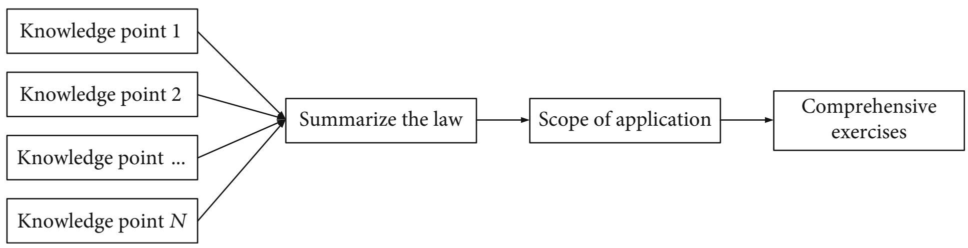

Figure 4: Summary of the design structure.

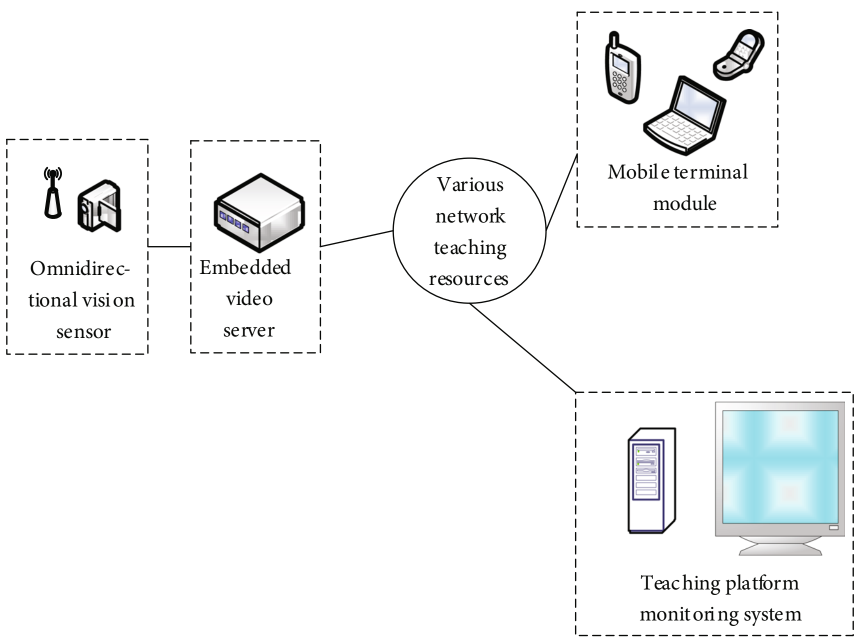

Figure 5: Simulation experiment environment.

reality-interactive classroom, the basic tests and intensive tests are added in the design of the interactive tests.

The interactive test module is mainly composed of the basic test and reinforcement test, and the basic test mainly includes a multiple-choice test, blank filling test, and judgment test. The reinforcement test is mainly a case operation. When the basic test is not successful, students can view the analysis and continue to learn the knowledge according to the system prompt. If the basic test is successful, the learner can enter the intensive test; there is no right or wrong in the intensive test stage; the student knowledge will operate the case assigned by the teacher and submit the work to the teacher for comments in class. The system will automatically proceed to the next stage of the study after the intensive test. Teachers need to follow the following step in preparing test questions: (1) making the purpose clear.

5. Experimental Results and Analysis

In order to further ensure the effect of its practical application, simulation experiments are carried out. In order to enhance the explanatory nature of the experimental results, the method of Reference [5] and the method of Reference [6] are used as a comparison. Select the virtual reality classroom account attribute information obtained from the network to carry on the validity experiment. With Google as the source of user attribute information, the website has finally obtained 3426 valid Google+ accounts, 3567 Facebook

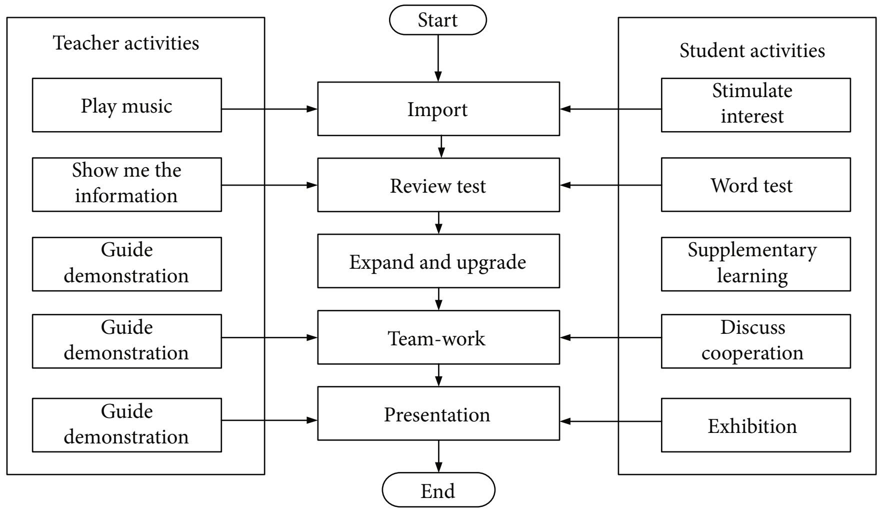

Figure 6: Flow chart of experimental teaching.

accounts, and 4712 Twitter accounts for the pages with nonempty homepage links to Twitter and Facebook, which are not invalidated and have public access rights. Other simulation and experimental environments are shown in Figure 5.

In the simulation experiment environment, 300 students were selected to carry out the experiment. Among them, 100 students applied the designed method, 100 students applied the method of Reference [5], and 100 students applied the method of Reference [6]. Compared with the three groups of students, the higher the study score was, the more effective the system was. The teaching process in the experiment is shown in Figure 6.

According to the above experimental process, the interactive classroom teaching quality evaluation simulation is carried out, and the distribution of virtual reality-interactive classroom resources is obtained as shown in Figure 7. A set of video learning resources with learning tasks is developed to assist the teaching work of virtual reality-interactive classroom and effectively improve students' autonomous learning ability. The teaching effect is obtained according to Formula (1) interactive classroom learning effectiveness evaluation model. The specific test results are shown in Figure 8.

Based on the distribution of teaching resources in Figure 7, the quantitative decision-making and statistical analysis in the process of interactive classroom teaching quality evaluation are carried out by using the teaching benefit and innovative evaluation mode. As can be seen from Figure 8, the test results of the teaching effect of this method are close to the actual predictions. In order to prevent the phenomenon of illegal copying in the process of experiment and then search for the answers from the Internet or the question bank and prevent the leakage of examination questions, the function of anticopying is added to the webpage code; in addition, a score table containing examination information is established, the relevant information is saved in the table at the beginning of the examination, and the examination status of the examinee is marked. The examinee's examination status will be changed when the examination paper is submitted or the examination time is reached, ending the

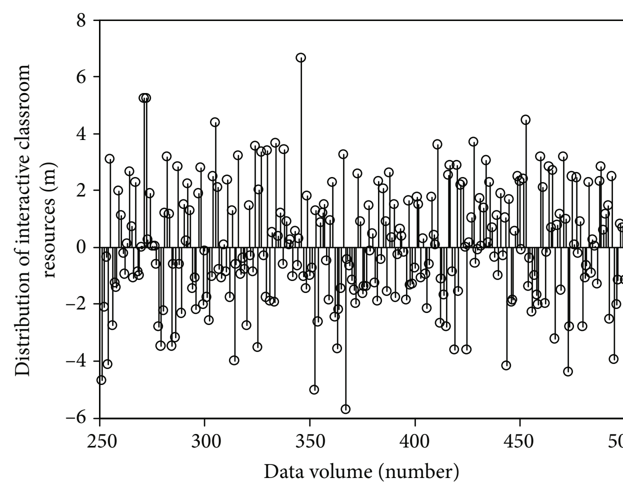

Figure 7: Distribution of virtual reality-interactive classroom resources.

examination automatically, so that the examinee cannot modify the examination result and cannot continue the examination even if he has not submitted the examination paper for any reason. At the same time, obtain the course name, test paper code, and other information of the examination, and then save these information and student number, class, exam certificate number, exam course, and the score of the examination to the examinee score table. The performance improvement rates of the proposed method, the method of Reference [5], and the method of Reference [6] are compared as shown in Figure 9.

As can be seen from Figure 9, the results of the application of this method have improved significantly, and the results are higher. The reason is that the information flow model constructed by this method to express the learning validity of differential equation in interactive class has good performance to a certain extent. In order to further study the feasibility of the virtual reality-interactive classroom based on the deep learning algorithm, the design method is

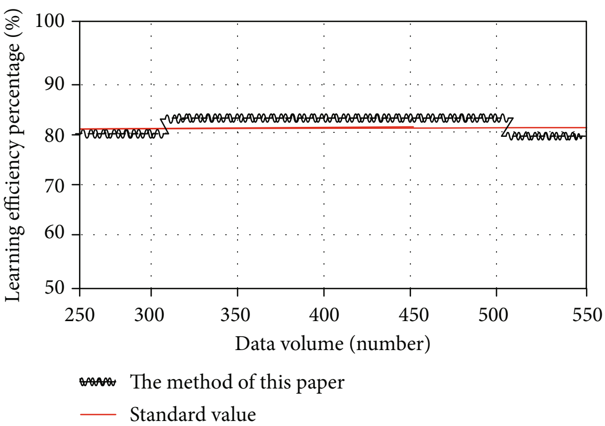

Figure 8: Test results of teaching effect.

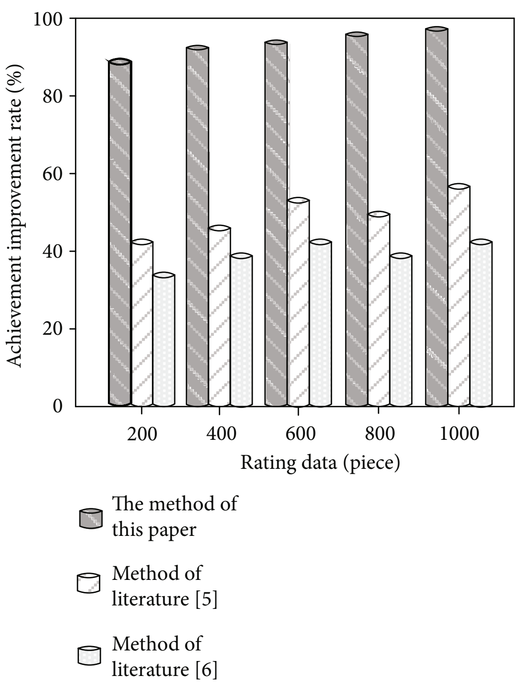

Figure 9: Comparison of performance improvement rates.

applied to the teaching resource platform. The specific simulation results are shown in Table 2.

Analysis of the experimental data in Table 2 shows that the overall stability of the virtual reality-interactive classroom has been greatly improved after the use of this method. The main reason is that in the design process of this method, a deep learning algorithm is used to analyze the virtual reality-interactive classroom; based on the explanatory variable model and the control variable model of learning effectiveness evaluation, and according to the distribution characteristics of the resources of the deep learning algorithm, association coefficient, average mutual information entropy, learning mode, and other constraint parameters, the statistical feature extraction is carried out, and the linear superposition output of the large number of bits of the statistical feature number of the virtual reality-interactive classroom learning effectiveness is obtained. To some extent, a large number of redundant data existing in the teaching resource platform can be deleted, the probability of attack and harm to the platform is reduced, and the stability of the whole platform is enhanced. Therefore, the above experiments can prove the effectiveness of the design method, and the system has a better application effect and practical application significance.

Table 2: Stability of teaching resource platform before and after using this method.

Distribution of interactive classroom resources	Platform stability before using this approach (%)	Platform stability with textual approach (%)
1	87.8	93.8
2	85.3	95.6
3	86.7	97.4
4	93.5	94.2
5	91.6	93.3
6	90.4	97.4
Average value	89.22	95.28

6. Conclusions

Based on the front-end analysis, this paper puts forward the design of virtual reality-interactive classroom learning content and the design of interactive classroom learning activity based on deep learning and develops the corresponding interactive classroom by this knowledge spot, the test study effect, carries on the summary, and the improvement of the insufficiency. After the above research, we get the following conclusions: On the basis of summarizing the previous definitions of microcourses, the definition of interactive microcourses is proposed from the perspective of deep learning algorithm. According to the characteristics of virtual reality-interactive classroom reoperation, this study divides the contents of the virtual reality-interactive classroom into four modules. They are the learning goal, video content, learning summary, and interactive test. And the corresponding model is designed to develop a virtual reality-interactive classroom. Through the investigation, it is found that the interactive microcourse can be applied to the personalized learning after class, which can arouse the students' interest in learning and help the learners to solve the problems in the actual operation.

Data Availability

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

Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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