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Research Article

Situational English Teaching Experience and Analysis Using Distributed 5G and VR

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Situational teaching has become an important issue in the current development of new teaching modes. The development of the fifth generation (5G) and virtual reality (VR) technologies provide powerful support for reforming the new teaching method. The smart education application scenario implemented by the immersive 5G+ VR smart classroom renders situational English teaching more efficient. Therefore, in this study, we design and analyze a new teaching scenario based on 5G+ VR technology for situational English teaching. First, we design the overall framework of teaching around teaching goals, learner characteristics, teaching resources, and teaching evaluation. We divide the virtual classroom into three different teaching processes: before, during, and after class. Second, we form a virtual classroom teaching system, which includes a cloud system, communication equipment, and a VR classroom applet. Finally, we design the interaction scheme between teachers and students in situational English teaching. The experimental results demonstrate that our method improves teaching effectiveness, which has significant implications for English teaching.

1. Introduction

The promotion and application of the fifth generation (5G) technology [1, 2] have led to the development of a new mode of coconstruction and sharing of educational resources. In this new era context, 5G was introduced into the campus, thereby helping the creation and development of smart education. Virtual reality (VR) is the use of computer technology to generate realistic visual and auditory tactile integration of a specific range of virtual environments [3, 4]. Utilizing the necessary equipment, the user interacts and influences the objects in the virtual environment naturally, resulting in an immersive feeling and experience.

5G is the next generation of mobile communications, which can provide faster upload and download speeds, wider coverage, and increasingly stable connections. The main direction of the new generation of mobile communication technology development is toward 5G, which forms an important part of the future generation of information and communications infrastructure. Compared with 4G, 5G has the technical characteristics of "ultrahigh speed, ultralow latency, and ultralarge connection," which will not only further improve users' network experience but also bring faster transmission speed to mobile terminals, meet the application requirements, and endow most things with the ability to connect online. The world is transitioning to mobile and consuming more data every year, especially with the growing popularity and increase in video and music streaming. Bandwidths have become more congested now, causing service disruptions, especially when many people in the same area attempt to access online mobile services simultaneously. 5G is better at handling several devices, from phones to device sensors and from cameras to smart streetlights.

One of the advantages of VR is its uniqueness in providing a 360-degree panoramic picture, unlike traditional video content [5, 6]. Users can not only feel the environment through sound but also fully influence it, and the sense of space and distance is more layered. This immersion enlivens

the VR experience, which is why the VR industry has emerged as an exciting industry. Neither television nor a computer can generate such a real feeling. Even the best computer gaming footage might not be as good as the experience of passing a blue whale by your side.

VR has a wide range of applications. In addition to its application in the gaming industry, it offers certain unique advantages in sectors such as teaching and medical treatment. However, the application of VR technology requires the support of a high network transmission bandwidth, which 5G can offer. The combination of 5G and VR has revitalized many sectors.

The smart education application scenario implemented by the immersive 5G smart classroom renders situational English teaching more efficient [7–9]. The immersive 5G smart classroom uses the VR teacher classroom mode in the 5G network environment, the remote teaching collaborative 4 K/8 K high-definition video mode, the holographic immersive future teaching mode, and the mobile teaching mode to explore more efficient and interesting teaching methods. Through the 5G + education application, multiple smart education application scenarios can be created, and simultaneously, a new ecology of 5G + smart education can be gradually built [10–12].

Live teachers combined with VR can broaden students' thinking and lead them to the VR world to experience a real and comprehensive teaching experience. For example, in the VR space scene experience, students can virtually travel to space and observe its characteristics such as the shape and color of each planet from 360 degrees. Combined with the classroom VR experience, students can imagine the future application scenarios of VR technology through group discussions.

The traditional video transmission technology has the problems of communication barriers between students and teachers and has difficulty in controlling the effect of students' classroom listening, which adversely impacts teaching effectiveness [13]. The headset of VR technology can better ensure that students keep up with the content of the teacher's lessons, which is more advantageous than traditional methods in distance teaching. The immersive feeling of VR technology, especially the real teaching scene combined with the actual teaching content, is more intuitive, can promote the enthusiasm of students, and is more aligned with the dominant thinking characteristics of primary and secondary school students' intuitive and perceptual image thinking. This is not only conducive to promoting the transfer of students' knowledge and forming a clear understanding but also helps students to form a correct understanding.

Driven by 5G, the picture of education transmission on the VR platform as well as data splitting is clearer [14, 15]. This disassembles and labels the teaching and research content and becomes the basis for recording each student's reflection on the learning content of each stage. Based on this big data, parallelly, the overall analysis and recording of the teaching courses are conducted during the class to control the shape of the classroom scene and run through all aspects of learning. Applying VR technology to teaching applications can present the traditional incomprehensible knowledge points to the virtual scene. Through VR equipment, students are immersed in interactive learning in virtual situations, providing students an immersive experience.

From the perspective of English immersion teaching, VR teaching can create a good teaching situation for college students who are learning English and promote the development of intelligent, scene-based, and efficient English teaching. Immersive English teaching means that learners can interact naturally with the environment, including other learners or mentors connected through the network, implying that learners feel immersed and highly engaged. The best method to achieve English immersion learning is to let students feel and experience a scene that is close to real life. However, time, distance, safety, and other issues encumber reproducing all the scenes in the actual teaching process. The application of VR technology provides the possibility for immersive English teaching, which implies that learners can combine the theory with practice after learning the theory. In the virtual environment, learning is no longer just boring memorization and recitation, but the application of the knowledge they have learned to real scenarios. The precise simulation and real-time interactivity of VR technology directly affect the quality of classroom teaching.

In this paper, we analyze the application experience of 5G and VR technology in situational English immersion teaching. The main contributions of this paper are summarized as follows: (1) we design the overall framework of teaching around teaching goals, learner characteristics, teaching resources, and teaching evaluation, where the virtual classroom is divided into three different teaching processes: before, during, and after class. (2) We form a virtual classroom teaching system, which includes a cloud system, communication equipment, and a VR classroom applet. (3) We design the interaction scheme between teachers and students in situational English teaching.

The rest of this paper is organized as follows: Section 2 introduces the teaching method designed for situational English teaching based on 5G+ VR technology, including the teaching process, presentation in class, and interaction design. Section 3 presents experimental studies and results to compare and demonstrate the performance of the designed teaching method under two English teaching methods. Section 4 concludes the paper.

2. Immersive Teaching Design based on 5G+ VR

In recent years, the development of VR technology has received considerable attention, and with the further popularization of 5G networks, online teaching has emerged as one of the most popular teaching methods besides school teaching [16, 17]. Based on this feature and the needs of the current teaching content, we attempt to develop and explore the course mode and resources and apply 5G+ VR technology to the English teaching scenario.

Instructional design is a process of systematically designing and realizing learning objectives. It follows the principle of optimal learning effect and is the key to the quality of courseware development. First, we design the overall framework of teaching around teaching goals, learner

characteristics, teaching resources, and teaching evaluation. The virtual classroom solves various problems of traditional education through different task-based teaching of "before class, during class, and after class," to optimize the learning effect. Second, based on the characteristics of the existing 5G+ VR technology, we design a virtual classroom teaching system, which includes a cloud system, communication equipment, and a VR classroom applet. The combination of each subsystem and teaching design is introduced as follows.

2.1. Teaching Process. As mentioned above, the virtual classroom can be divided into three different teaching processes: before class, during class, and after class. The overall design of the teaching process is illustrated in Figure 1.

In the "before class" stage, the microlecture videos and preview test questions corresponding to the courses that students will learn are extracted from the cloud system through the platform and pushed. The system can select auxiliary materials and videos to be used in the classroom according to the teaching content. Teachers constantly adjust the teaching content according to students' test scores and feedback to move it closer to students' actual level, which can greatly improve their learning enthusiasm.

In class, interactive platform software is used to build a simulated environment with foreign locales for students, such as vacations abroad, pick-up at international airports, cafes, cafeterias, and lawns, to improve students' practical application and oral English abilities. Teachers and students realize voice communication and barrage interaction through the communication system in the virtual classroom. The data transmission network built based on the 5G system meets the needs of the VR port for cloud data uploading and data sharing with high speed, a large amount of time, large delay, and small delay.

After class, according to the students' test feedback before class and the interaction in the virtual classroom, teachers arrange personalized games for students in the WeChat applet and set up small game rewards. Through various means such as virtual character upgrades, virtual equipment rewards, and side quest promotion, the interest of learners is further stimulated and the learning results are consolidated. These teaching processes fully utilize 3D modeling and visualization techniques to provide real or near-real environments and situations, creating a strong sense of immersion and motivating learners. Authenticity improves environment fidelity, control reliability, and user experience. Authenticity not only means that the created environment and the objects it contains have a high sense of reality but also implies that the problems created originate from real life and have real meaning.

2.2. Presentation in Class. For students to learn efficiently in virtual classrooms, practical, economical, and convenient VR equipment is indispensable. These devices include both headsets and virtual desktop environments.

The VR devices in the market today are mainly of three types with a wide range of applications: mobile headsets,

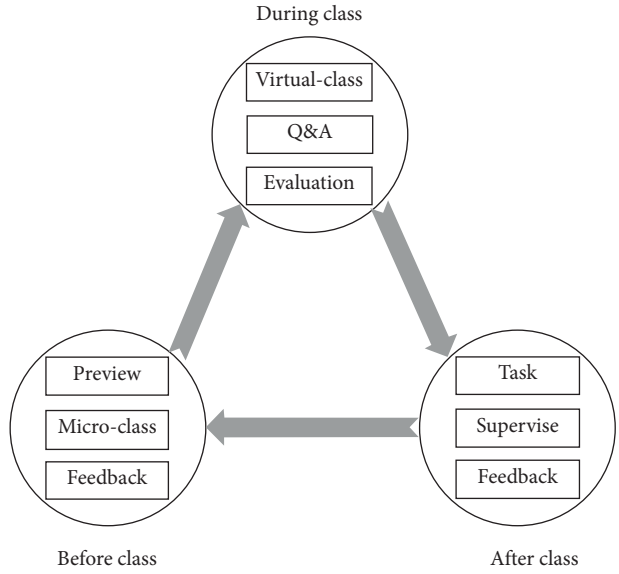

Figure 1: Overall design of the teaching process.

external wearable devices, and all-in-one headsets. Among them, the mobile head-mounted display has the simplest structure and the lowest price, although the user experience is poor and cannot adequately achieve the purpose of virtual classroom learning. The external wearable device has an independent processor and is equipped with a special operating system, which simplifies its use. The all-in-one head-mounted display has the best imaging effect and is free from the shackles of external data cables.

Desktop VR (WebVR) [18, 19] uses personal computers and low-level workstations for simulation and the computer's display screen serves as a window for learners to experience VR. Desktop virtualization technology can enable the terminal desktop application environment to exist independently without relying on the hardware environment [20, 21]. Therefore, the cost of VR on the desktop is relatively low and it compensates for the need for the healthy development of students' eyesight. Therefore, this technology has a wide range of applications and is the best medium for the current fantasy English learning. The implementation of desktop VR application software relies on the development of WebGL technology [22, 23]. WebGL creates and runs 3D images on the browser. It follows the OpenGL ES specification and writes shader code through the GLSL language, including vertex and fragment shaders. The code written in GLSL is compiled to the GPU, then mapped to the OpenGL API for calling, and finally returned to WebGL rendering. The development process can include VR data initialization, WebGL initialization, and animation rendering as shown in Figure 2.

In addition to self-developed desktop VR software, we also consider using products that have been developed in the market, such as the video player of play2VR, which supports multiterminal use, is convenient, and low-cost. Using it only entails registering an account, uploading the premade media (course video or picture), and then copying the integrated code to the port of the WeChat applet [24], after which

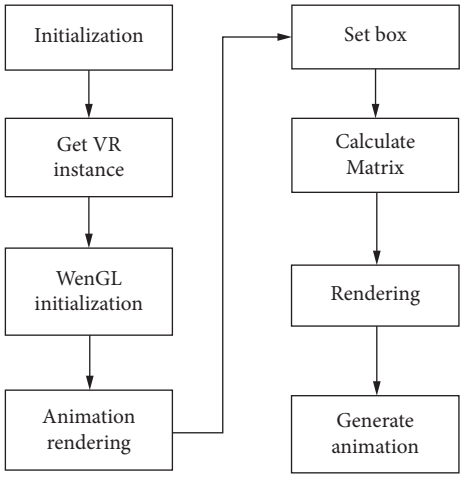

Figure 2: Development process of WebVR.

students can participate in the virtual classroom online learning on the student side.

2.3. Interaction Design. Interaction is an indispensable link in the learning process and has the functions of communicating information, diagnosing learning situations, emotional exchange, and promoting reflection. Interaction is a psychological need and self-actualization whose main purpose is to provide help and guidance to the learner to obtain timely learning feedback. Interaction design includes two parts: student interaction and teacher interaction.

In the English teaching situation, students' activities are mainly based on exploration, learning, and experience. Students appear in the virtual space in the form of avatars, can roam in the virtual space, interact with virtual objects to perceive information, and observe objects from various angles. The first-person perspective can be used in the design. At this time, the scene that students view is consistent with the scene that the avatar views. This perspective has a good sense of substitution and can produce a strong immersive psychological experience. A third-person perspective can also be used, where students can observe not only the scene but also their avatars. In the "reflective situation" and "concept forming situation," students' activities are mainly based on reflection, observation, discussion, sharing, dialogue, operation, and practice and can be designed into competitions, entertainment, and other forms. For example, if students answer the question correctly, some words of praise or sounds can appear in the virtual space, or they can be rewarded with virtual items. In the "verified situation," students' activities are to solve similar problems, test the acquired knowledge, and consolidate the learned concepts through activities such as tests, operations, decision-making, and exploration.

The role of teachers in the experiential teaching environment is mainly to assist learners to experience the situation, guide and communicate timely, and help learners to reflect and summarize. Instructors design corresponding activities according to different roles. As students are the main body of experiential learning in a virtual environment, the role of teachers in the design should be weakened to the maximum possible extent, and students' learning subjectivity should be highlighted. The design of experiential learning activities should play the role of the learner's main body.

The interactive form of a VR-based experiential learning environment can be designed either explicitly or implicitly. Explicit interaction means that learners can always view interactive elements, such as highlighting colors, flashing displays, and indicating arrows of interactive elements in the scene, so that learners can use them at any time. Implicit interaction implies that the elements interacting in the scene do not always exist, and only appear when the learner reaches an area, and the interactive elements disappear automatically when they leave this area. The purpose is to provide temporary prompts to enable barrier-free learning. From the perspective of interactive subjects and objects, it is divided into two situations: human-virtual object interaction and human-human interaction. In virtual space, both interaction situations are very important. The interaction between humans and virtual objects can promote the learner's experience, while human-to-human interaction can enhance learners' reflection. It should also fully consider VR-specific interaction technologies and devices, such as the use of "motion capture," "haptic feedback," "voice interaction," "eye tracking," and other interactive technologies to achieve natural interaction, which helps to increase the sense of immersion.

According to the interaction between the virtual and real classrooms, we divide classroom teaching into three stages, continuously implement feedback and exploration of classroom teaching activities, and plan to develop a teaching design that integrates virtual and real formats. The design map of the 5G+ VR-based classroom teaching method employed in this study is shown in Figure 3.

3. Analysis of Immersive Teaching Implementation based on 5G+ VR

In this section, we experimentally verify the designed method based on the 5G+ VR in the situational English teaching analysis proposed in this study.

Aiming at the situational English teaching analysis method based on 5G and VR technology designed in this study, we conduct some experiments to verify the effect of the designed method in English teaching. In the experiment, we select 20 students in the English classroom to conduct classroom tests. The effectiveness of the method is verified from the following three experiments:

(1) whether the concentration time in English learning is improved

(2) whether the learning efficiency is improved

(3) whether the learning interest is improved

In the first experiment, we continue to monitor the English learning focus time of 20 students. Specifically, in the experiment, we continuously examine each student's attention at the beginning of learning and record their concentration

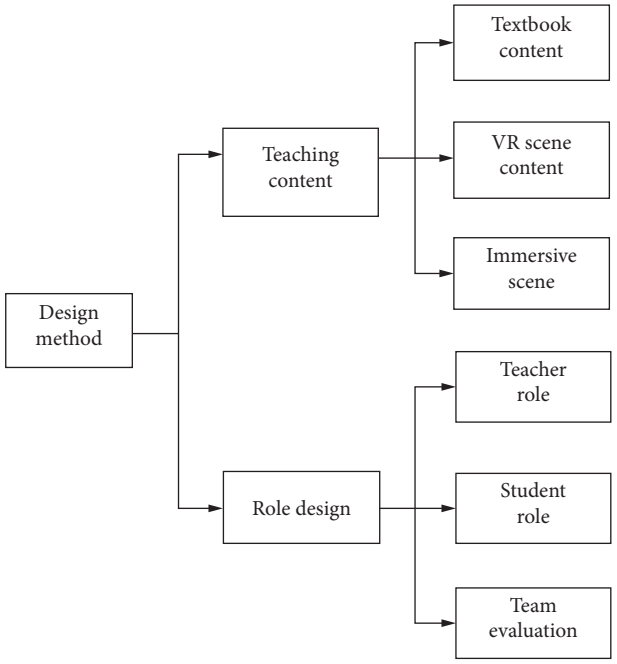

Figure 3: Design map of the 5G+ VR-based classroom teaching method.

Table 1: The results of the concentration time of students in the two groups of experiments.

No.	Normal	5G+ VR	Improvement
1	15	28	13
2	16	30	14
3	13	24	11
4	18	28	10
5	19	29	10
6	14	26	12
7	16	34	18
8	18	31	13
9	20	28	8
10	13	24	11
11	21	30	9
12	18	31	13
13	17	32	15
14	13	34	21
15	24	31	7
16	16	27	11
17	20	29	9
18	17	24	7
19	18	28	10
20	19	31	12

time in real-time. Notably, the duration of each lesson in the experiment is 40 minutes. To compare the role of 5G+ VR technology in situational English teaching, we compare two groups of experimental data. One group used the 5G+ VR technology in the situational English teaching method designed in this study, whereas the other group used the common teaching mode. Table 1 presents the results of the concentration time of students in the two groups of experiments, where "normal" represents the normal teaching model, and 5G+ VR represents the 5G+ VR technology in the situational English teaching method designed in this study. As evident from Table 1, in the second teaching mode, that is, the 5G+ VR model, students' concentration time in the classroom is greatly improved compared to the ordinary teaching mode.

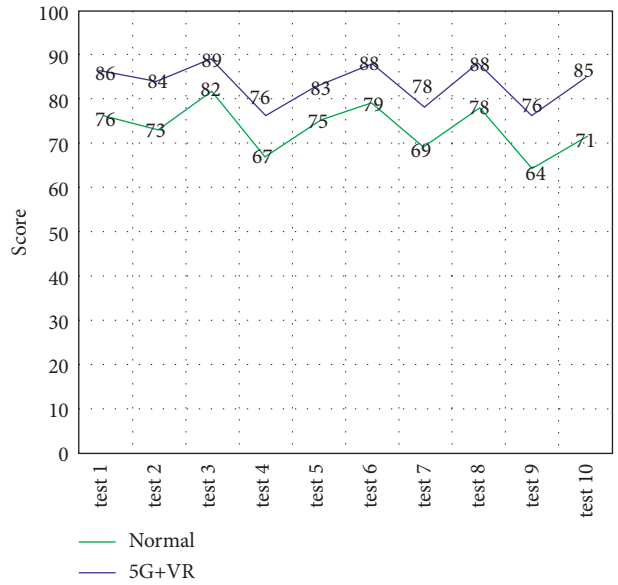

Figure 4: The average scores achieved by students in the 10 tests under the two teaching schemes.

In the second experiment, we design 10 test scenarios to test whether students' learning efficiency improved. In other words, we compare the learning efficiency of students in the situational English teaching scheme using 5G+ VR technology and the ordinary teaching scheme. Figure 4 depicts the average scores achieved by students in the 10 tests under the 2 teaching schemes. As evident from Figure 4, the average scores of students in the situational English teaching plan using 5G+ VR technology are higher than those of ordinary teaching methods, which demonstrates that students' learning efficiency is improved in the situational English teaching plan using 5G+ VR technology.

In the third experiment, we test whether students' interest in learning improved by recording the number of student-teacher interactions. Thus, we compare the number of interactions between students and teachers in the situational English teaching plan using 5G+ VR technology and the general teaching plan. Table 2 describes the number of 20 student-teacher interactions in both tests under the two teaching scenarios.

Table 2 illustrates that in the situational English teaching plan using 5G+ VR technology, the number of interactions among students is significantly higher than that in the ordinary teaching method, which indicates that students' interest in learning improves by using the 5G+ VR technology in the situational English teaching.

We can draw the following conclusions from the above-given experiments. First, compared with traditional education methods, 5G+ VR teaching can achieve maximum utilization of resources without being limited by time and region. Simultaneously, the immersive scene can fully

Table 2: The interactions times under the two teaching methods.

No.	Normal	5G+ VR
1	1	2
2	1	3
3	0	1
4	1	2
5	1	1
6	2	2
7	0	3
8	0	2
9	2	2
10	1	2
11	1	3
12	1	2
13	1	3
14	1	2
15	2	4
16	1	2
17	0	2
18	2	4
19	1	3
20	1	1

transmit the teacher's teaching content to students, effectively communicate and interact between teachers and students, and answer questions timely. This mode can restore the vivid learning mode to the maximum possible extent and can also improve the learning experience of students. Second, two major problems still exist in the realization of virtual classrooms: (1) too few VR course resources have been developed and the production process is relatively slow; (2) the equipment for realizing virtual classrooms still cannot fully realize comprehensive immersive learning, and learners could be disturbed by the outside world while studying. The application of VR in English teaching can indeed increase the learner's ability to use language and promote the all-around development of the learner. To ensure the popularity of VR English teaching, and considering the characteristics of students' physical development, WebVR is the most reasonable method to realize this teaching mode. With instant synchronization of data from a computer, mobile phone, or tablet, students can seamlessly switch learning devices, thereby increasing learning flexibility.

4. Conclusion

In this study, we analyzed a teaching scene-based 5G+ VR technology for situational English teaching. We first designed the overall framework of teaching around teaching goals, learner characteristics, teaching resources, and teaching evaluation. We divided the virtual classroom into three different teaching processes: before class, during class, and after class. Second, based on the characteristics of the existing 5G+ VR technology, we designed a virtual classroom teaching system, which included a cloud system, communication equipment, and a VR classroom applet. Finally, we designed the interaction scheme between teachers and students in situational English teaching. The experimental results proved that the method designed in this study improved performance in teaching effectiveness, which has great significance for English teaching.

Data Availability

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

Conflicts of Interest

The authors declare that there are no conflicts of interest in this article.

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