

VR Language Labs Revolutionize New Paths for Practical Language Teaching and Learning

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Abstract: Focusing on the innovative application of the language laboratory integrating virtual reality (VR) technology in practical language teaching. By analyzing the dilemma of traditional language teaching, it reveals its shortcomings in the creation of real language environment, diversity of teaching methods and richness of learning resources. The unique advantages of VR technology in language practice teaching are explored to build an immersive learning environment, customize personalized learning programs and carry out interactive teaching activities. The study shows that the innovative application significantly improves students' academic performance, learning interest and participation, and promotes the development of comprehensive language ability. It provides new ideas and methods for the innovative development of language practice teaching, and is of great significance in promoting the modernization of language education.

Keywords: Virtual Reality Technology; Language Laboratory; Language Practice Teaching; Innovative.

1. Introduction

1.1. Research Background

The traditional language practice teaching mode relies on textbooks, teachers' lectures and limited classroom interactions, and the teaching scene is often confined to the classroom, where students mainly acquire language knowledge and information through the textbooks' words, pictures and teachers' verbal explanations. Classroom interaction is usually based on teacher questions, student answers and group discussions, which tends to restrict students' motivation and initiative, and makes it difficult to meet their increasing demand for individualized learning. Lacking a real language environment and immersive learning experience, students are relatively weak in the practical use of language, and when facing real cross-cultural communication scenarios, they often have problems such as poor language expression and inaccurate cultural understanding.

1.2. Research Objectives and Innovations

To explore the innovative application paths and methods of the language laboratory integrating VR technology in language practice teaching. By deeply integrating VR technology into language practice teaching, an immersive and interactive language learning environment is constructed to stimulate students' learning interest and enhance their comprehensive language application ability in oral expression, listening comprehension and cross-cultural communication. The innovative integration of VR technology into the language laboratory breaks through the spatial and resource limitations of traditional laboratory teaching and creates a highly realistic and immersive language learning environment for students. Based on VR technology, an interactive and personalized teaching mode is constructed, which breaks the single mode of teacher-led teaching in traditional teaching, emphasizes students' active participation and independent learning, and provides a new way of thinking for the innovation of language teaching mode.

1.3. Research Methods

Through extensive review of domestic and international academic journal articles, dissertations, research reports, monographs and other related literature, we systematically sorted out and analyzed the current status of the application of VR technology in the field of education, especially in language teaching, the development trend, theoretical foundations and practical experience. To understand the research results and shortcomings in this field, to avoid duplication of efforts, to provide solid theoretical support and research ideas for the subsequent research, and to clarify the value and potential problems of the application of VR technology in language practice teaching.

2. Core Concepts and Theoretical Cornerstones

2.1. Anatomy of VR Technology

2.1.1. Principle and Characteristics of VR Technology

VR technology integrates computer graphics, simulation technology, sensing technology, information network technology and other cutting-edge technologies of comprehensive information technology, using computers to generate a highly realistic virtual environment, so that the user, with the help of specific head-mounted displays, joysticks, data gloves and other equipment, interacts with the objects in the virtual environment in a natural way, thus obtaining an immersive experience.

At the image processing level, VR devices capture dynamic information such as the user's position, posture, acceleration, angular velocity, etc. in real time through multiple sensors such as built-in gyroscopes, accelerometers, and magnetometers. The data captured by the camera equipped with high image quality will be transmitted to the computer, which renders the virtual environment in real time based on these data, generating images with different perspectives for the left and right eyes. Image de-distortion, resolution conversion, distortion and other processing techniques are used to optimize image quality and enhance the user's visual

experience.

Physical simulation with the help of computer simulation of the physical world of mechanics, optics, acoustics, electromagnetism and other physical laws, for the user in the virtual environment to bring a more realistic feeling. VR physics engine simulation gravity, collision, friction and other physical phenomena, so that the user in the operation of the virtual character or object, can feel similar to the real world of the physical feedback, to enhance the sense of realism and fun of the game.

Human-computer interaction realizes the free interaction between users and the virtual environment. VR devices are equipped with controllers such as handles, gloves, etc., and users move, rotate, and grab objects in the virtual environment through the devices. Combined with voice recognition technology, users interact with the virtual environment through voice commands, further enhancing the convenience and naturalness of interaction [1]. Head tracking technology realizes a more intuitive and natural interaction experience through the rotation of the head.

VR immersion Through a full range of visual, auditory and even tactile feedback, VR technology completely wraps the user in the virtual environment, so that he or she feels as if he or she is truly in the virtual world, and devotes himself or herself to the virtual scene, which stimulates the user's sense of participation and interest in learning.

Interactivity is that in VR language practice teaching, students have conversations with virtual characters in the language lab, choosing different contents and ways of conversations according to their own language level and learning needs, so as to realize personalized learning. Students complete various language learning tasks by operating shopping in the virtual supermarket and asking about the price and quantity of goods in the target language, so as to improve the practical application of language.

Autonomy In the VR environment, virtual objects have a certain degree of intelligence and autonomy, and can make corresponding responses according to the user's behavior and environmental changes, making the virtual environment more realistic and vivid, and providing a richer and more diverse experience for the user. In language learning, the virtual character language lab gives students immediate feedback and guidance based on their language performance, helping them correct pronunciation, grammatical errors and other problems, just like having an exclusive language tutor.

2.1.2. Hardware and Software System of VR Technology

The hardware devices of VR technology are head-mounted display (HMD), handle, sensor, data glove and so on. Head-mounted displays create an immersive visual experience by presenting the images of the left and right eyes separately to the user [2]. Head-mounted displays such as HTC Vive, Oculus Rift, Pico 4, etc., are characterized by high resolution, high refresh rate and large field of view, providing users with a clear, smooth and expansive visual experience.

The handle realizes the function of operating, moving and selecting virtual objects in language practice. The handle has multiple buttons and functional areas to meet the diverse operational needs of users. When the user collides with the virtual object or performs a specific operation, the handle will vibrate, giving the user more realistic tactile feedback and enhancing the interactive experience.

Sensors in VR technology capture the user's movement, position and posture information in real time, providing accurate data support for the VR system. Gyroscopes,

accelerometers, magnetometers, etc. work together to achieve accurate tracking of the user's head, hands and other parts of the user to ensure that the user's movements in the virtual environment get timely and accurate response.

The data glove is an interactive device that captures the user's hand movements and gestures in real time, allowing the user to interact with the virtual environment in a more natural and intuitive way. The data glove adopts advanced sensor technology to accurately sense the user's finger bending, stretching and other movements, and translates them into corresponding commands transmitted to the VR system.

The software of VR technology includes operating systems, development tools and applications, etc. Operating systems such as Steam VR of HTC Vive and Oculus Home of Oculus are the basic platforms for VR devices, responsible for managing hardware resources, providing basic system services and supporting the operation of various applications. Optimized for the characteristics of VR applications, they better support the hardware functions of VR devices and provide a smoother and more stable operating environment.

Unity, Unreal Engine and other development tools provide developers with the environment and interface for creating, editing and debugging, which are VR applications. With powerful functions and rich plug-in resources, they help developers quickly create high-quality VR applications. Unity, the game engine applied to VR development, supports a variety of VR devices, provides rich graphic rendering, physical simulation, human-computer interaction and other functions, and has good cross-platform, which makes it convenient to publish VR applications to different platforms.

Applications are VR technology in many fields such as games, education, medical care, architecture, tourism, etc. In the field of practical language teaching, VR applications provide students with rich and diverse learning resources and scenarios such as virtual language learning classrooms, virtual language and culture experience scenarios, and virtual language communication platforms. Combined with the characteristics of VR technology, it creates an immersive and interactive learning environment for students, which effectively improves the effect and quality of language learning [3].

2.2. Panoramic Presentation of Language Laboratory

2.2.1. Language Lab Functions and Characteristics

As a new type of teaching place integrating modern information technology and advanced teaching concepts, the language laboratory has intelligent teaching assistance functions, with the help of advanced speech recognition, semantic analysis and other technologies, it accurately recognizes and analyzes students' speech in real time, and not only accurately judges whether students' pronunciation is standard, but also corrects errors in grammar and vocabulary use. When students practice speaking, the system can automatically mark the syllables with inaccurate pronunciation and provide a demonstration of standard pronunciation to help students correct pronunciation errors in time. Through semantic analysis of students' language expressions, it points out grammatical errors and improper vocabulary use and gives corresponding suggestions for improvement, which greatly improves the accuracy and efficiency of language learning.

The interactive communication function breaks the time and space limitations of communication between teachers and

students in traditional language labs and builds a diversified interactive platform. Teachers initiate interactive activities such as group discussion, role-playing, situational dialogues and so on through the system of the language laboratory, and students communicate freely in the virtual scene, fully exercising their language expression and communication skills [3,4]. Through the function of remote connectivity, students communicate with foreign language learners in real time during language practice, realizing cross-cultural language interaction, broadening the horizons of language learning, and enhancing cross-cultural communicative competence.

Personalized Learning Through big data analysis technology, we comprehensively collect and analyze students' learning progress, learning habits, knowledge mastery, weaknesses and other learning data, and customize a personalized learning plan for each student. According to the students' vocabulary test results and grammar mastery, the system automatically pushes learning materials and practice questions that are suitable for the level of the student, helping the student to learn and consolidate in a targeted manner. For students with faster learning progress, it provides extended learning content to meet their learning needs; for students with learning difficulties, it provides more tutoring and practice resources to help them improve gradually [5].

The resource integration and sharing function makes the language laboratory a rich language learning resource base. It integrates a large number of language learning resources, covering a variety of language teaching materials, audio, video, e-books, online courses and other resources to meet the learning preferences and needs of different students. Through the online platform, students can access the lab's resource library anytime and anywhere for independent learning. Teachers upload their own teaching resources to the resource library to realize the sharing of resources and to promote teaching exchanges and cooperation among teachers.

2.2.2. Language Laboratory Components

The efficient operation and excellent functions of a language laboratory depend on the synergy of hardware facilities, software systems and teaching resources.

Hardware facilities provide the necessary physical conditions for teaching activities. The laboratory is equipped with high-performance computer equipment, these computers have strong computing power and graphics processing capabilities, smooth running of a variety of language teaching software and virtual reality applications. High-resolution monitors, high-quality sound systems, and comfortable tables and chairs and other equipment also create a good learning environment for students, ensuring that students have a clear visual and auditory experience during the learning process and improving the comfort of learning. Realizing the application of virtual reality technology in language teaching is also equipped with professional head-mounted displays, handles, sensors and other VR equipment, which enables students to immerse themselves in the virtual language environment, realizing natural interaction with the objects in the virtual scene, and enhancing the sense of immersion and interest in learning. Supporting multi-person collaborative learning and interactive communication, the lab is also equipped with a large screen projector, interactive whiteboard and other equipment, which is convenient for teachers to conduct teaching demonstrations and organize group activities for students. Network equipment is also an important part of the hardware facilities. High-speed and

stable network connection ensures rapid transmission and sharing of teaching resources, and realizes distance teaching and online communication.

The software system is the core support of the language laboratory, which determines the function and teaching effect of the laboratory. The laboratory has installed special language teaching software, which covers functional modules such as listening training, speaking practice, reading comprehension, writing tutoring, etc. The software has intelligent teaching assistance functions, provides personalized learning suggestions and feedback according to students' learning situation, and helps students improve their learning efficiency [6,7].

Virtual reality software is the key to realize the application of VR technology in language teaching. Through virtual reality software, a variety of realistic virtual language communication scenes, cultural experience scenes, language practice scenes and other language learning scenes are created, so that students can learn and practice language in the virtual environment, and improve their language application skills and cross-cultural communication skills[8]. The laboratory is also equipped with teaching management software, which is used to manage and monitor teaching resources, students' learning, teachers' teaching activities, etc. It is convenient for teachers and administrators to understand the teaching dynamics and adjust teaching strategies in time.

Teaching resources are an important part of the language laboratory, providing rich materials and contents for teaching activities. The laboratory has a large number of language teaching materials resources, including paper and electronic teaching materials, which cover different language levels and teaching objectives and meet the learning needs of different students. Rich audio and video resources such as foreign language original movies, TV dramas, news broadcasts, and recordings of spoken conversations are also an important part of the teaching resources, which allow students to be exposed to real language environments and improve their listening and speaking skills. Various e-books, academic papers, research reports and other literature resources provide students with materials for in-depth study of language and culture. Online course resources are also an important supplement to teaching resources. Students learn high-quality language courses provided by well-known universities and educational institutions at home and abroad through the lab's online platform, which broadens learning channels and enriches learning content. To meet the needs of virtual reality teaching, the Lab has also developed and collected a large number of virtual scene models, virtual character models, interactive teaching courseware and other VR teaching resources to provide students with a richer and more immersive learning experience.

2.3. Theoretical Support for Teaching Language Practice

2.3.1. Theories of Language Learning

Behaviorist theory believes that learning is a linkage between stimulus and response and emphasizes the important influence of external environment on learning [9]. In language laboratory practice, learners form correct language responses through repeated stimulation and reinforcement. Operant conditioning theory considers language learning as a process of gradually forming correct language behaviors through reinforcement. In language teaching, language learning is facilitated by giving students timely feedback and

rewards to reinforce their correct language expressions. In vocabulary teaching, students' ability to memorize and use words is reinforced by having them recite the words repeatedly and by giving praise and rewards to students who spell and use the words accurately.

Cognitivist theory holds that learning is the processing and understanding of information. In the language laboratory practice, learners construct a language knowledge system through cognitive activities such as perceiving, memorizing and thinking about language information, which is gradually developed and perfected in the interaction with the environment. They assimilate and conform to the new linguistic information according to their existing cognitive structure, so as to realize the improvement of language ability. In grammar teaching, students are guided to deepen their understanding and use of grammar by analyzing sentence structure and understanding grammar rules, and by incorporating new grammatical knowledge into their existing cognitive structure. Constructivist theory emphasizes the active constructive, social interactive and contextual nature of learning. Learners actively construct their own knowledge system through interaction and collaboration with others. In practical language teaching, constructivist theory emphasizes the creation of authentic language situations in which students can use language to communicate and interact, so as to improve their practical language application skills. In role-playing activities, students play different roles and use the target language to communicate in simulated real-life situations, which not only improves their language expression ability, but also enhances their understanding of the language and culture and cross-cultural communication skills. The theory of constructivism focuses on the individual differences of learners and the cultivation of independent learning ability, emphasizes the contextual and social nature of learning, and provides a more practical and energetic teaching mode for language practice teaching.

2.3.2. Situated Learning Theory

Contextual learning theory emphasizes the creation of real language situations for students, so that they can feel the language, understand the language and use the language in the context. In the language laboratory integrating VR technology, the language laboratory utilizes VR technology to create a variety of realistic virtual language communication scenarios, cultural experience scenarios, business negotiation scenarios and other language learning scenarios. In the virtual language communication scenarios, students feel as if they are in the streets and alleys of the target language country, and communicate with the locals in real life, so as to improve their language expression and listening comprehension skills through actual dialogues and interactions. In the cultural experience scene, students feel the cultural atmosphere of the target language country, understand the local customs and habits, history and culture, etc., and enhance their understanding of the language and culture, so that they can better use the language for cross-cultural communication.

Contextual learning theory also emphasizes the social interactivity of learning. Through group discussion, role-playing, project cooperation and other activities, students communicate with each other, learn from each other and improve their language skills together. In group discussion, students discuss a certain language topic and share their views and ideas. In the process of communication, they not only practice their language expression skills, but also broaden their thinking horizons and learn from other people's language

expressions and ways of thinking. In role-playing activities, students work together with their peers to complete the role tasks, improve the accuracy and fluency of language use in the process of interaction, and enhance the teamwork spirit and communication skills.

3. Insights into the Dilemmas of Language Practice Teaching

3.1. Disadvantages of Traditional Teaching Mode

3.1.1. Lack of Real Language Environment

In traditional language practice teaching, students mainly learn language knowledge through the text and pictures on the textbooks, lacking direct contact with the real language environment, and the learning method that is detached from the actual context makes it difficult for students to really understand how the language is used in real life and the cultural connotation. When learning a foreign language, students may memorize a large number of words and grammatical rules, but in actual communication, when faced with real native speakers of a foreign language or foreign language communication scenarios, they don't know what to do and can't express their ideas accurately and fluently. There is a certain gap between this and real language use scenarios, and the language knowledge students learn in class cannot be directly applied to real life.

Under the traditional teaching mode, communication between students is also mostly based on the scenarios and topics set by the textbook, lacking a natural and real communication atmosphere. In the speaking practice session, although students will practice dialogues, these dialogues are often carried out to complete teaching tasks, lacking real communication purposes and emotional expression, making it difficult to effectively improve students' oral expression and communicative competence. Students may just mechanically recite pre-prepared sentences in the dialogues without the ability to really understand and use the language to communicate, and once they encounter actual communication scenarios, they will have problems such as expression difficulties and misunderstanding.

3.1.2. Single Teaching Method

The traditional teaching method of language practice is relatively single, which is based on the teacher's lecture, and the teacher occupies a dominant position, imparting language knowledge to the students through explanation, board writing and other ways, while the students passively accept the information transmitted by the teacher, neglecting the students' main position and the cultivation of learning initiative. In grammar teaching, teachers usually explain the grammar rules in detail, and then let students consolidate what they have learned by doing practice problems. Although students are allowed to master a certain amount of grammar knowledge, they often just memorize the rules and lack the ability to deeply understand and flexibly apply the grammar knowledge.

A single teaching method is also difficult to meet the learning needs and learning styles of different students. There are differences in each student's learning ability, interests and learning styles, and traditional teaching methods often use a "one-size-fits-all" approach, which is not able to personalize teaching for individual differences in students [10]. For students with strong learning ability, they may feel that the

teaching content is too simple and lacks challenge, thus losing interest in learning; while for students with weak learning ability, they may feel frustrated because they cannot keep up with the teaching progress, which affects their motivation to learn.

3.1.3. Limited Learning Resources

Traditional language practice teaching relies on learning resources, mainly textbooks and teachers' lectures, which are relatively limited in number and variety. Textbooks, as the main learning resources, are updated slowly, making it difficult to keep up with the development of the times and language changes. The language materials in some textbooks may be outdated and unable to reflect the real language usage and cultural background, which makes the language knowledge and cultural information that students are exposed to obsolete, and is not conducive to students' understanding of the latest language dynamics and cultural trends. In addition to textbooks, there is a relative lack of other learning resources for students to use in traditional teaching. Although libraries are rich in language learning materials, they are not easy to find and use, and some of them may be outdated. In the process of learning, students often only rely on the limited listening materials and reading articles provided by teachers, and it is difficult for them to obtain more diversified learning resources. In terms of listening training, students may only be able to practice through the listening tapes or CD-ROMs accompanying the textbooks, and the number and types of listening materials are limited, which can't satisfy students' diversified listening learning needs.

3.2. Exploring the Root Causes of Existing Problems

3.2.1. Lagging Educational Concepts

Traditional education concepts have long dominated the teaching of language practice, focusing too much on the transmission of knowledge, simply equating language learning with the memorization and accumulation of vocabulary, grammar and other knowledge, and ignoring the essential attributes of language as a tool for communication. Teaching objectives tend to focus on the degree of mastery of students' knowledge of the language, and test scores are taken as the main criterion for measuring the results of students' learning. In the curriculum, a lot of time is allocated to grammar and vocabulary memorization, while the practical aspects such as oral expression and listening training are relatively weak. The educational concept of focusing on knowledge but not ability makes the students, although they achieve better results in the written examination, often face many difficulties in the actual use of the language for communication, unable to express their ideas accurately and fluently, and find it difficult to adapt to real-life language communication. The traditional education concept emphasizes the teacher's dominant position.

The traditional education concept emphasizes the dominant position of the teacher, who plays the role of knowledge transmitter in the teaching process, while students are in a passive state of accepting knowledge. This teacher-centered teaching mode limits students' initiative and creativity [11,12]. In the classroom, teachers tend to teach according to established teaching plans and lesson plans, paying less attention to students' individual differences and learning needs. Students can only passively follow the teacher's rhythm, and lack the opportunity to think and explore independently, making it difficult to develop independent

learning and problem-solving skills. In oral teaching, teachers may correct students' grammatical errors too much and neglect the cultivation of students' fluency and self-confidence, resulting in students being too nervous to speak up when expressing themselves, which affects the effect of language learning.

The teaching content under the traditional education concept is often limited to textbooks and classrooms, and lacks a close connection with real life and social needs [11]. The language materials in the textbooks may have a certain gap with real life and cannot reflect the real language usage and cultural background at present. Teaching activities are also mostly carried out in the classroom, and students lack contact and interaction with the real language environment. This kind of detached teaching content and method makes it difficult for students to apply the language knowledge they have learned to real life, and they cannot really understand the cultural connotation carried by the language, which reduces students' interest and enthusiasm in learning. When learning a foreign language, the dialogue scenes in the textbooks may be too idealized and different from the actual foreign language communication scenes, which makes it difficult for students to apply what they have learned to real communication and leads to poor learning results.

3.2.2. Insufficient Application of Technology

In terms of hardware facilities, the language labs in some schools are equipped with old and aging equipment, and the computer configuration is low, which can't run advanced language teaching software and virtual reality applications smoothly. The number of VR equipment is insufficient to meet the needs of students' use, resulting in limited opportunities for students to participate in VR language learning. The language labs in some schools lack high-speed and stable network connections, which affects the transmission and sharing of teaching resources and limits the development of online teaching and interactive communication. When conducting online listening practice, due to unstable network, audio files load slowly or even lag, which seriously affects students' learning experience and learning effect.

In terms of software resources, some language teaching software has single function, lacks innovation and interactivity, and cannot meet the diversified learning needs of students, and the teaching content is not updated in time, so it is difficult to keep up with the pace of language development and changes in the social demand for language talents. The development and application of virtual reality teaching resources are relatively lagging behind, and there is a scarcity of high-quality VR language teaching courses and scenarios, which can't give full play to the advantages of VR technology in language teaching, and it's difficult to stimulate students' interest in learning and improve their language application ability.

Teachers' technical application ability is also an important factor affecting the application effect of technology in language practice teaching. Some teachers have a low level of mastery of modern educational technology and lack the ability and experience of using information technology in teaching. In teaching, they still rely on traditional teaching methods and means, and are not skilled enough in the use of language teaching software and multimedia equipment, etc. Although they are equipped with advanced teaching equipment, they can only use it as a kind of decoration due to their unfamiliarity with the operation of the equipment and the function of the software, and they can't really apply it to

teaching, which leads to low teaching efficiency and poor teaching effect.

4. VR-enabled Language Laboratory Innovation Path

4.1. Immersive Learning Environment Construction

4.1.1. Virtual Scene Design and Construction

The design and construction of the virtual scene is the basis for building an immersive learning environment, which needs to take into full consideration the goals and needs of language learning, and combine the culture, history, geography and other elements of the target language country to create a highly realistic and educational scene. To help students learn business foreign language, the language lab designs a virtual international business meeting scene, which contains different functional areas such as meeting hall, negotiation room, rest area, etc., and each area is equipped with projectors, conference tables, display racks and other facilities and decorations related to the business meeting, and it also sets up virtual participants of different nationalities, whose dress, behavior and communication methods are in line with their respective cultural backgrounds. Their dress, behavior and communication styles are all in line with their respective cultural backgrounds.

When building the virtual scene, advanced 3D modeling technology is used to accurately model objects, buildings, and people in the real world, presenting a lifelike virtual environment for students. The 3D scanning technology is used to obtain the shape, texture and other information of the real objects, which are imported into the modeling software for fine processing, so that the objects in the virtual scene have a high degree of realism. When building the virtual language learning classroom, 3D modeling of the desks, chairs, blackboards, podiums, etc. in the classroom, from the texture of the material, color reproduction to the detailed features of the objects, all strive to be consistent with the real classroom, so that when students enter the virtual scene, it is as if they are in a real classroom.

The interactive design of the scene allows students to freely communicate and interact with the language in the virtual scene. It is necessary to design a rich variety of interactive elements, set up a variety of books, maps, cell phones and other interactive props, and students pick up these props in the language lab through the handle and other devices to communicate with the virtual characters and obtain relevant language information. In the virtual cultural experience scene, interactive tasks such as visiting museums and participating in traditional festival celebrations are set up, and students need to complete these tasks and interact with other characters in the scene, so as to improve their language application skills and cross-cultural communication skills, and greatly enhance their sense of participation and motivation in learning.

4.1.2. Realization of Multi-sensory Interactive Experience

Through the comprehensive use of visual, auditory, tactile and other multi-sensory technologies, VR technology that realizes multi-sensory interactive experience effectively enhances the immersive learning effect of students. In terms of vision, a high-resolution head-mounted display is the basic requirement. High-resolution screens present clearer, more detailed images, reducing the graininess and blurriness of the

screen, enabling students to better observe the details of the virtual scene and enhancing the realism of the visual experience. HTC Vive Pro 2, with a binocular resolution of up to 5K, provides students with extremely clear visual effects, allowing them to feel an immersive visual impact in the virtual scene.

The eye-tracking technology language lab captures students' eye movements in real time and dynamically adjusts the image rendering according to the direction of the student's line of sight to achieve more accurate visual interaction. When a student observes an object in a virtual scene, eye tracking technology renders the object more finely according to the focus of the student's line of sight, highlighting the part of the object that the student is focusing on and improving rendering efficiency and realism. When students look at a word or sentence, the system language lab automatically zooms in, labels it, or provides relevant explanations to facilitate student learning.

Spatial Audio Technology The language lab accurately calculates the propagation path and direction of sound according to the position of the student's head and the location of the sound source in the virtual environment, generating audio effects with a sense of three-dimensionality and orientation. When virtual characters in different directions speak, students can clearly feel the direction and distance of the sound source, as if they are actually in the communication scene, which enhances the sense of auditory immersion. When students walk on the virtual street, the sound of promotional announcements from the store in front, the sound of the horn of the vehicle in the back, and the sound of the surrounding pedestrians' conversations are all presented with realistic audio effects according to their position and movement status, allowing students to better integrate into the virtual environment.

Haptic feedback allows students to feel the shape, texture, weight and other physical characteristics of the corresponding objects when touching virtual objects through haptic gloves, force feedback devices, etc. When a student picks up a virtual book, the haptic gloves simulate the texture and weight of the book's paper, while the force feedback devices provide the language lab with a sense of resistance when picking up the book to make the student's haptic experience more realistic. For practical language learning tasks, the virtual kitchen is used to learn cooking-related language knowledge, and students feel the strength of knives cutting ingredients and the touch of pots and pans through the haptic devices, so as to enhance the realism and fun of learning. To build an immersive learning environment, design and build realistic virtual scenes and realize multi-sensory interactive experience, create a highly realistic and immersive language learning environment for students, effectively stimulate students' interest and enthusiasm in learning, and improve the effect and quality of language learning.

4.2. Personalized Learning Solutions

4.2.1. Learning Data Analysis and Evaluation

In the language laboratory integrating VR technology, learning data analysis and assessment is the basis for realizing the customization of personalized learning plan. By collecting, organizing and analyzing multi-source data generated by students in the process of language learning, a comprehensive and in-depth understanding of students' learning status and needs is provided to provide a scientific basis for the development of personalized learning programs [13].

The sources of learning data are rich and varied, covering students' behavioral data in VR learning scenarios, learning outcome data, and interaction data in the learning process. Behavioral data includes information such as students' learning time, learning path, and operational behavior in the virtual scene. Data such as the length of conversation with virtual characters, the frequency of initiating conversations, and the topics of conversation chosen by students in the virtual language communication scenario reflect students' interest and participation in learning. Learning outcome data include students' scores and performance in various language tests, assignments, and projects. Scores on listening tests, accuracy and fluency of oral expression, and the quality of writing assignments visualize students' mastery of language knowledge and skills. Interaction data contains information about students' interactions with VR devices, learning software, and other students and teachers, such as students' clicks, downloads, and use of learning resources, and the content of their speeches and level of participation in group discussions, etc. It helps to understand students' learning preferences and collaborative abilities.

Data mining technology discovers potential patterns and laws from massive data, and analyzes the correlation relationship between students' learning behaviors and learning outcomes through association rule mining to find out which learning behaviors have a significant impact on the improvement of learning outcomes [14]. Cluster analysis language labs group students with similar learning characteristics into one category and develop differentiated teaching strategies for different categories of students. Through cluster analysis, more targeted listening training resources and methods are provided for them.

Machine learning algorithms predict students' future learning performance by building predictive models in learning data analysis, identifying students who may have learning difficulties in advance and providing them with timely support and assistance. Based on students' previous academic performance and learning behavior data, they predict their performance in a certain future exam, and for students whose predicted performance is unsatisfactory, they adjust their teaching plans and provide them with additional tutoring and practice. Natural language processing technology, on the other hand, the Language Lab analyzes students' text-based learning data, semantically analyzes students' essays, discussion speeches, etc., and assesses students' linguistic expression and logical level of thinking.

The assessment indicators include traditional learning achievements, but also cover multiple dimensions such as learning interest, learning motivation, learning strategies, learning attitudes, etc. Learning motivation is assessed through the students' participation and active exploration behaviors in the VR learning scenarios, and learning motivation is judged by the students' learning goal setting and the degree of commitment to the learning tasks. Learning strategies are assessed by students' use of learning resources, time management ability and problem solving ability, etc., so as to more accurately grasp students' learning status and needs and provide strong support for the formulation of personalized learning programs.

4.2.2. Adaptive Learning Path Planning

Based on the results of learning data analysis and assessment, planning adaptive learning paths for students is the key to realizing personalized learning. Adaptive learning path dynamically adjusts the learning content, learning

difficulty and learning mode according to students' individual differences and learning progress, so as to make the learning process more in line with students' actual needs and improve the learning effect [15,16].

When planning the adaptive learning path, the language level, learning needs and learning goals of students are clarified, and language learning is divided into different stages and levels, with clear learning goals and tasks set for each stage. For students at the beginner level, the learning goal is to master basic vocabulary, grammar and simple expressions of everyday language; students at the intermediate level focus on improving comprehensive language use, including reading comprehension, writing and more complex oral communication; and students at the advanced level focus on cultivating cross-cultural communication skills and in-depth comprehension and use of language.

Personalized learning resources are recommended for students based on their learning and assessment results [17]. For students with weak vocabulary, vocabulary learning software and vocabulary memorization methods suitable for their level are recommended, and vocabulary games and vocabulary cards in VR scenes are used to help students memorize words. For students who have difficulty in listening comprehension, we provide rich listening materials such as dialogues, lectures, news, etc. with different speeds and themes, and gradually adjust the difficulty of the materials according to the students' listening level. During the learning process, the recommendation of learning resources is adjusted in real time according to the students' learning progress and feedback to ensure that students always acquire the most suitable learning content for themselves [18].

The choice of learning modes should also be optimized according to the individual differences of students. For visual learners, the language lab provides more visual learning resources such as images and videos, and helps them understand and memorize language knowledge by displaying vivid pictures, animations, and videos in VR learning scenarios. Auditory learners are better suited to learning through listening materials and audio explanations, and more listening exercises and audio interactive activities are designed for them. Kinesthetic learners like to learn through practice and operation, and the language lab arranges for them to participate in more VR language practice activities such as role-playing and simulated business negotiation, so that they can improve their language application skills in actual operation.

Adaptive adjustment of learning difficulty is also an important part of planning learning paths. When students excel in a certain knowledge point or learning task, the learning difficulty is appropriately increased to provide them with more challenging learning content and stimulate their learning potential. If students encounter difficulties in the learning process and still cannot master a certain knowledge point after repeated attempts, the system automatically reduces the learning difficulty and provides more supplementary learning resources and guidance to help students overcome the difficulties and gradually improve their learning ability.

4.3. Interactive Teaching Activities

4.3.1. Real-time Teacher-Student Interaction Mode

In VR language practice teaching, the real-time teacher-student interaction mode presents characteristics and

advantages that are very different from those of traditional teaching. With the powerful function of VR equipment, teachers and students realize all-round and multi-angle real-time communication in the virtual environment, breaking the limitations of space and time in the traditional classroom and making the teaching interaction more natural, smooth and efficient.

In the virtual language learning scene, real-time communication with students is carried out through voice, gestures and other means. When students practice language in the virtual scene, the teacher observes the students' performance in real time, including the accuracy and fluency of language expression and the use of body language. Once students are found to have problems, they are immediately guided by voice to correct pronunciation errors, grammatical problems or provide more appropriate expressions. Teachers also use the annotation function of the VR equipment in the language lab to mark and annotate students' errors directly in the virtual scene, so that students can understand their problems more intuitively. In the virtual business negotiation scene, when students are negotiating with virtual customers, they observe the students' language use and communication skills, point out the students' deficiencies in expressing their needs and responding to their queries in a timely manner, and give them suggestions for improvement, so as to help them improve their business language communication skills.

The interaction between teachers and students is not only limited to language instruction, but also includes emotional communication and stimulation of learning motivation. In the VR environment, the facial expression recognition technology captures students' emotional changes in real time to understand their learning status and psychological needs. When students show confusion or frustration, teachers give timely encouragement and support to enhance students' learning confidence. Teachers guide students to actively participate in learning activities through interaction with students, stimulating students' interest and initiative in learning. In the virtual cultural experience scene, discussing the cultural practices of the target language country with students and sharing interesting cultural stories stimulate students' desire to explore the culture and thus learn the language more actively.

Further enhance the effect of real-time interaction between teachers and students by introducing intelligent teaching aid systems. Using artificial intelligence technology, students' learning data are analyzed in real time to provide teachers with personalized teaching suggestions [19,20]. The system language lab recommends targeted teaching content and practice topics for teachers based on students' language level, learning progress and common errors to help teachers better meet students' learning needs. The intelligent teaching aid system also language lab automatically generates students' learning reports, recording students' learning process and progress in detail, providing strong support for teachers' teaching assessment and feedback.

4.3.2. Group Collaborative Learning Activities

Group collaborative learning activities have unique advantages in the language lab with VR technology, which can effectively promote communication and cooperation among students and enhance their comprehensive language application ability and teamwork spirit. Through VR technology, students form groups in the virtual environment and work together to complete various language learning tasks such as group discussion, role-playing, project

cooperation, etc. [8].

In group discussion activities, students language labs communicate in virtual meeting rooms or discussion scenarios. Each student clearly saw the virtual images and expressions of other group members and heard their voices through the VR device, as if they were actually sitting in the same conference room for the discussion. During the discussion, the students in the language labs discussed specific language topics in depth, shared their views and ideas, and learned from and inspired each other. When discussing the topic of "environmental protection", the students' language labs used the target language to share their knowledge of environmental protection, the problems they face, and the solutions, which not only practiced their language skills, but also broadened their horizons of thinking, and learned about different perspectives and views.

Role-playing is more vividly presented in the VR environment, where students play different roles in the language lab and communicate and interact with each other in the virtual scene. In the virtual restaurant scene, one part of the students played the role of a waiter and the other part of the students played the role of a customer to improve the practical application of language by simulating the dialogues during the ordering and eating process. Students need to use appropriate language to express themselves according to the characteristics of the role and the situation, which not only requires students to master rich language knowledge, but also need to have certain adaptability and communication skills. Through collaboration with group members, students can better understand the relationship and interaction between characters and improve the accuracy and fluency of language communication.

Project collaboration activities are where students form groups in the language lab to work together to complete a language learning project such as producing a report on the culture of the target language country, making a language learning video, etc. During the collaborative project, students need to divide up the work and use their language skills and knowledge to complete the project tasks. In the project of making a cultural report, some students were responsible for collecting information, some were responsible for writing the report, and some were responsible for presenting the report in the target language. Through project cooperation, students not only improve their comprehensive language application skills, but also develop teamwork, organizational and coordination skills and problem solving abilities.

To ensure the smooth implementation of group collaborative learning activities, teachers need to organize and guide them effectively. Teachers should first clarify the objectives, tasks and requirements of the activities, help students to group reasonably, and ensure that the members of each group have a certain degree of complementarity in terms of language level, learning ability and interests. In the process of the activity, the teacher should pay close attention to the progress of each group, give timely guidance and support, and solve the problems encountered by the students. When there is an impasse in the group discussion, students are guided to think about the problem from different perspectives to stimulate the enthusiasm of the discussion; in the role-playing, the students' performance is commented on and suggestions for improvement are made to help students improve their performance level and language use ability [21]. At the end of the activity, teachers should organize students to summarize and reflect, evaluate the performance of groups and

individuals, share the gains and experiences in the activity, and promote the common progress of students [3].

5. Conclusion and Outlook

5.1. Summary of Research Results

The innovative application of the language laboratory integrating VR technology in language practice teaching has been discussed in depth, the principles and characteristics of VR technology and its theoretical basis for its application in the field of education have been systematically sorted out, and the relevant theories of language practice teaching have been analyzed in depth, which provides a solid theoretical support for the subsequent research. The characteristics of VR technology such as immersion, interactivity and autonomy are clarified, which can effectively make up for the lack of real language environment, single teaching method and limited learning resources in traditional language teaching, and provide a new perspective for the innovation of language practice teaching. By building an immersive learning environment, using advanced 3D modeling technology and multi-sensory interactive experience, a highly realistic language learning scene is created for students. In the virtual language communication scene, students feel the cultural atmosphere of the target language country and communicate naturally with the virtual characters, which effectively improves the interest and effect of language learning.

5.2. Prospect of Future Research Direction

With the rapid development of artificial intelligence technology, combining VR with artificial intelligence to develop a language learning system with intelligent interaction function, so that the virtual character can provide more personalized and intelligent learning guidance and feedback according to the students' language level and learning status. Utilize the natural language processing technology of artificial intelligence to realize more fluent and natural dialogue and communication between virtual characters and students, and improve the interactivity and effect of language learning.

Increase the development of high-quality VR language teaching resources, encourage teachers, educational institutions and enterprises to participate in the creation of teaching resources, and enrich the types and contents of teaching resources. Develop VR language teaching resources with regional characteristics and cultural connotations to meet the learning needs of different students and promote the inheritance and exchange of language and culture. Develop language learning scenarios and teaching contents with local characteristics according to the language and cultural characteristics of different regions, so that students can understand and inherit the local culture while learning the language.

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