Research Article

Effectiveness Evaluation Model of Students' English Listening Ability Based on Immersive Computing

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In the context of the integration of China's international economic development, the country has an increasing demand for high-level English professionals. Therefore, schools need to strengthen the teaching of students' English learning and improve students' comprehensive English ability. College English listening course is an important course to cultivate students' English skills. Improving the teaching effect of college English listening course has become an urgent problem in English teaching. With the development of China's network technology and education reform, a brand-new three-dimensional virtual immersive environment teaching model has emerged. This teaching model is of great help to students in learning English. This paper applies immersion theory to college English listening teaching, using virtual reality technology to create a three-dimensional virtual immersive environment for English listening teaching and using this new environment to promote English listening teaching, stimulate students' interest in English learning, and improve students' English. The ability of listening comprehensively improves the efficiency of English listening teaching, thereby making college English listening lessons lively and interesting and rich in information, and helps students have an immersive experience, so as to cultivate students' interest in learning, form learning motivation, and ultimately achieve the goal of improving their English proficiency. The method proposed in this article organically integrates the teaching, learning, and evaluation of English listening. First of all, it can evaluate the attribute grasping mode and its advantages and disadvantages of groups and individuals in the process of listening and cognition. Relying on the network, it can also provide real-time networked diagnosis reports and targeted guidance. Secondly, teachers can discover the characteristics and needs of individuals and groups based on the diagnosis results, adjust and optimize their own teaching methods, and truly teach students in accordance with their aptitude. More importantly, students can find problems through self-diagnosis and obtain effective guidance and intervention, which finally help them to move towards autonomous learning. This is also the ultimate goal of modern English education. From this perspective, this research also helps to open up new directions for future English research.

1. Introduction

In the context of the integration of China's international economic development, the country has an increasing demand for high-level English professionals. Therefore, schools need to strengthen the teaching of students' English learning and improve students' comprehensive English ability. College English listening course is an important course to cultivate students' English skills. Improving the teaching effect of college English listening course has become an urgent problem in English teaching. In English learning, the most important thing is to cultivate students' English listening ability, and English listening is the most difficult link in English subjects to learn and master. Therefore, in the process of learning, students will have a psychological burden on English learning due to the obstructive factors in English listening learning. English listening learning in a virtual immersive environment uses external factors to help students conduct listening training in a specific environment, so as to achieve the purpose of improving students' English listening ability [1–7].

The immersion theory was first proposed in 1975 by the internationally renowned Hungarian American psychologist Harry Chixentmihaiy. This theory was aimed at explaining

why people are fully involved in the situation when performing certain daily activities, concentrate their attention, and filter out all irrelevant perceptions, and enter a state of immersion. Through a large number of investigations and empirical studies, Harry found that "people are involved in an activity without being affected by other interferences. This experience is so pleasing that people cannot care about any price and pay, and people are completely out of it. Do it out of interest in the thing itself," He called this state "immersion" and collectively referred to these feelings as "immersion experience," as shown in Figure 1.

Traditional English teaching is at the expense of the students' mother tongue, while the three-dimensional virtual immersive environment teaching coexists with the mother tongue. In other words, the three-dimensional virtual immersion teaching realizes a teaching mode that combines isolation and pure teaching with other multielement subjects, thereby providing students with a new natural language environment when learning English listening. In addition, in the traditional mode under the circumstances, the scope of students learning English listening is relatively narrow, and the mother tongue language interference is usually added when learning English, making students cannot truly participate in the learning of English peacefully. The three-dimensional virtual immersive teaching uses students fixed in a specific environment, any communication and life in this environment use the target language, so that students are completely in an English learning environment, which is very effective for students to improve their English listening ability [8–11].

For example, according to a 2013 survey of schools that use 3D virtual immersion methods for English listening teaching, it is found that most students have improved their English listening ability to varying degrees in receiving 3D virtual immersion teaching. In addition, through the combination of immersive teaching and life learning, students not only strengthen their English listening ability but also greatly improve their English language skills. At the same time, through immersive learning, students' creative ability and intellectual level have been maximized. In addition, under the traditional English listening teaching mode, students' language and listening exercises basically come from the classroom, and students' learning to strengthen English listening can only be repeated mechanically and extensively. In this teaching mode, it is easy to make students feel fatigued in English listening, thereby reducing their ability to learn English listening. English listening learning in a virtual immersive environment can create a closed language learning environment for students, so that students can enhance their subjective awareness of learning English listening in this environment and then improve their English listening skills. Therefore, in terms of the comparison between the two, the relevant state departments conducted a virtual immersion teaching experiment on the fifth grade students of a certain school. After a period of time, most of the students in the whole year can quickly understand English essays and can fluently talk and do writing in English language. At the same time, the results of language tests conducted on grade-level students show that students

can only understand the simplest English listening content without accepting virtual immersion learning. After receiving a period of virtual immersion teaching, students are basically able to complete more complicated English listening tests, and the accuracy rate is as high as 95% [12–20]. If the process of "overcoming challenges—skills growth—overcoming more difficult challenges—skills level" continues to grow, students will achieve self-growth [21–26].

The realization of the immersion state lies in the matching of skills and challenges, that is, the level of knowledge and skills a person has to match the difficulty level of the problem that needs to be solved. If the difficulty of the problem is too high, it will cause anxiety (anxiety) and will make people feel bored (boredom). In addition, there are two mental states that will appear when skills and challenges do not match. The details will be introduced in the theoretical foundation part of this article [27–33].

In the organization of teaching design, if the individual can be immersed, it will not only stimulate students' interest in learning but may also improve learning performance. In daily life, at least the following three conditions can be met to induce immersion in individual activities: (1) the activity has a clear goal; (2) the activity can provide clear feedback; and (3) the individual thinks the activity is challenging and the level of skill is comparable. The theory of immersion and the tutorial case complements each other. First, scholars believe that the guided learning case should have the effect of helping students learn independently. Autonomous learning ensures that the student is the center, and the process of learning and the control of learning are greatly returned to the students themselves. According to the related research of immersion theory in the field of education, the autonomous control of students can increase the degree of students' participation in the learning process and thus make it easier to reach the immersion state. Secondly, teachers can guide students into a state of immersion while studying through certain means, and the study guide can be used as a tool to complete this task.

2. Teaching Method of Three-Dimensional Virtual Immersive Environment

The immersion state is the core concept in the immersion theory, and the entire immersion theory system and its application are carried out around the immersion state. Immersive state is a kind of "best experience," it means that the individual is completely involved in the activity, so that he does not care about the outside world's opinion of himself but at the same time still has a strong sense of control over the activity. The test proves that the 3D virtual immersion teaching plays a vital role in improving students' English listening ability, as shown in Figure 2. Therefore, our country should follow the following teaching methods in English listening teaching: (1) Creating an immersive teaching model in the large environment of English listening learning is the key to improving the level of English teaching and creating an overall social environment. It is very important for learning a new language. For example, the first sentence a child speaks is the mother tongue used, which is the result
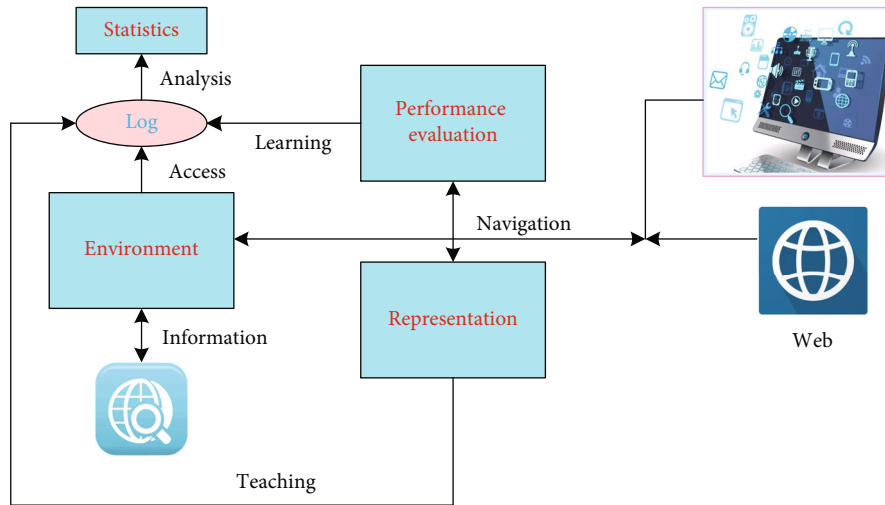
Figure 1: Immersion experience.

Figure 2: 3D virtual immersion teaching.

of imperceptibility; before the child speaks, the parent does not provide professional training for it, which is the influence of the general environment. In the same way, our students also need the influence of the general environment when learning English listening. In addition, virtual immersive environment teaching needs the learners' own enthusiasm and learning initiative to cooperate. Therefore, when the school develops the virtual immersion teaching of English listening, it should create a good English listening learning environment for students, so that students can truly enjoy the process of being touched by the ears and eyes and put students in an English language environment.

For example, in the immersive teaching of English listening in a school, students are required to use English when designing blackboard newspapers and hand-written newspapers, and the school's broadcast station broadcasts the morning and afternoon news from the original native language to English. Ensure that as long as the students are on campus, they cannot do anything without the impact of the English environment. In addition, English teachers should use English to communicate and communicate with students from beginning to end in the classroom teaching, so that students can fully feel that learning English is not a difficult thing, so as to improve students' enthusiasm for

learning English and strengthen their English. In Listening ability, at the same time, the school has consciously created a good English listening learning environment for students. It is stipulated that during a certain period of time in the school, students must use spoken language to communicate. If they violate the school's regulations, they must be punished for one day or three days of full-day oral communication. Use this punishment method to improve students' oral English ability.

If they are in a state of immersion during the learning process, the students will unconsciously focus their cognitive resources on the materials in front of the comprehension process. In addition, the school has to also set up English signs in all public places on campus, such as do not step on grass, do not fold the flowers, and other English words, so that students can be in the atmosphere of English language all the time.

(2) In changing roles and improving the teaching level of English listening, more than half a century ago, an educator in the UK once said that foreign languages are learned, not taught. It can be seen that the subjective factor of learning English is not the teacher but the student. At the same time, the main purpose why we require our students to learn English listening is to enable students to master another

language communication method in addition to their native language. It can also be said that the strength of English listening ability is directly related to the future development and survival of students. Therefore, it is very important for the improvement of students' English listening ability how teachers play the main performance of students in classroom teaching. Teachers need to start from two points in the classroom teaching of English listening, namely, guiding students' initiative in subjective learning and teaching students the learning methods of English listening

For example, when the teacher trains students to learn subjectivity, they first use advanced multimedia technology to visually display the spoken English content and divide the English dialogue into multiple character dialogues in the form of animation, so that the students can determine the learning through the visual spoken language display subjective initiative. In this way, students can be immersed in English conversation, thereby creating a good atmosphere for students to learn English listening. In addition, teachers have also exchanged roles in classroom teaching, transforming the teaching of students' learning content into a mode of teaching students' learning methods and teaching students the skills in English listening learning. At the same time, in the teaching of English listening, teachers should teach students in accordance with the different characteristics of students in order to improve students' English listening ability from the root. The students' attention will be quite concentrated, making it difficult to perceive the passage of time.

In addition, teachers should make full use of network multimedia resources in English listening teaching, such as images, computers, slides, and other tools and methods. Multidirectional mobilization motivates students to learn English listening, so as to improve students' English listening level. The error and amplitude are shown in Figure 3.

(3) Organize and create an English listening learning environment for mutual communication. In traditional English listening teaching, there is often a misunderstanding. People's conventional English listening learning should be to listen to an English conversation continuously and repeatedly. In this kind of learning environment, students are prone to get bored, which affects their ability to learn English listening. With the change of people's ideas and the improvement of education level, people gradually realize that the learning of English listening can be carried out in a certain language environment. Therefore, in the English listening teaching based on the virtual immersive environment, the teacher needs to organize the students in the class to create a good English communication and interaction platform, and when creating a relaxed and happy classroom teaching atmosphere, students must actively participate in it. For example, the teacher can form several groups of students by randomly pairing the classmates, and then, the teacher randomly plays an English listening session in the classroom, which can be in the form of dialogue or in the form of essays. Then, let the students in each group discuss based on what they heard. During the discussion, the teacher should encourage the students to dare to say all the English content they have heard, so as to improve the students' English listening and speaking skills. In the immersive state,

students will have a sense of pleasure and accomplishment in what they have done, and they will devote themselves to the things at hand.

In addition, in the classroom teaching, teachers can also create a good English listening learning environment for students through group competitions, telling English stories, etc., so that students can master the most basic English listening learning in this virtual immersive environment. Skills and structural concepts of listening and speaking promote wider exchanges and cooperation among students. Teachers should organize students to participate in interesting English discussions in class, so that students can listen to English all the time, use English all the time, and think English all the time, so as to cultivate students' ability to communicate in English and express things in English. In addition, in the post-English listening teaching in a virtual immersive environment, teachers should also strengthen the study of teaching models. For example, you can create some English listening teaching framework models centered on the virtual immersive environment teaching model and carry out immersive English listening and speaking training, immersive English listening and dictation practice content, etc., and strive to comprehensively improve the level of English teaching. In addition, in order to create a good virtual immersive environment for English listening, the teacher can also collect and download some English songs according to the students' hobbies and let them listen to the English songs during their spare time or during class breaks. Under normal circumstances, learning to listen to English songs and memorizing English words far exceeds the speed of memorizing words used in listening to English conversations or English articles. Therefore, teachers can strengthen the training of students' English listening ability based on this feature. The power variation is shown in Figure 4.

3. Effectiveness Evaluation Model of Students' English Listening Ability

The DINA (Deterministic Inputs, Noisy, and Gate) model is a discrete latent variable model that allows inferences about the cognitive information (and substantive information) of the items, the cognitive attributes of the examinees, or expert knowledge about the domain to produce a more integrative framework of Q-matrix validation. After students have experienced the immersion state, they will take the initiative to carry out similar learning activities to feel the immersion state again, thereby generating internal motivation for learning.

In order to build a theoretical formulation of DINA model, three elements are needed. The first element is statistically presented as follows:

$$\xi_{ic} = \prod_{a=1}^{A} \alpha_{ca}^{q_{ia}}, \tag{1}$$

where ξ_{ic} is the latent variable to define whether test-takers in attribute mastery pattern c (i.e., mastery class c) can answer item i correctly, q_{ia} is the binary vector which
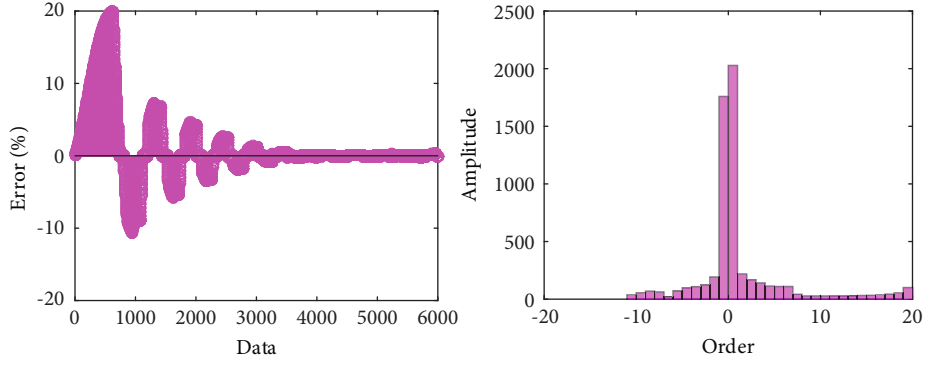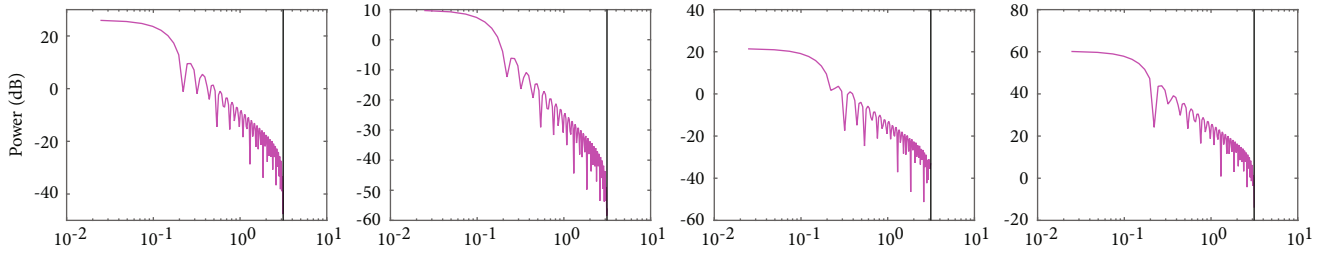
FIGURE 3: Error and amplitude.

FIGURE 4: Power variation.

demonstrates whether an item requires an attribute a, and α_{ca} is the binary vector which demonstrates whether an attribute a is mastered by the test-taker in class c.

If an attribute is not a must for the item, then

$$q_{ia} = 0. \tag{2}$$

In order to get

$$\xi_{ic} = 1. \tag{3}$$

It also means that

$$\alpha_{ic} = 1. \tag{4}$$

The two parameters seem to be the noise affecting the normal work of latent variables. The formulation is expressed as follows:

$$g_i = P(X_{ic} = 1 | \xi_{ic} = 0), \tag{5}$$

$$S_i = P(X_{ic} = 0 | \xi_{ic} = 1). \tag{6}$$

The probability of a correct response to item i is constructed as in the following equation:

$$\pi_{ic} = P(X_{ic} = 1 | \xi_{ic}). \tag{7}$$

And P meets

$$P = (1 - s_i)^{\xi_{ic}} g_i^{1 - \xi_{ic}}. \tag{8}$$

Therefore, it comes

$$\pi_{ic} = (1 - s_i)^{\xi_{ic}} g_i^{1 - \xi_{ic}}, \tag{9}$$

where X_{ic} denotes the observed response to item i for respondent in class c. Furthermore, when evaluating the goodness of fit for DINA, order constraint should be taken into consideration that

$$1 - s_i > g_i. \tag{10}$$

It defines the number of required attributes for item i as

$$A_i^* = \sum_{a=1}^{A} q_{ia}. \tag{11}$$

Among the three link functions for representing generalized model, identity link function, logit link function, and log link function, identity link function is adopted in this dissertation. The following is the expression:

$$P(\alpha_{li}^*) = \delta_{i0} + \sum_{a=1}^{A_i^*} \delta_{ia} \alpha_{la} + \sum_{a}^{A_i^*-1} A_i^* \sum_{a=1}^{l=a+1} \delta_{iaa'} \alpha_{la} \alpha_{la'} + \cdots + \delta_{i12 \cdots A_i^*} \prod_{a=1}^{A_i^*} \alpha_{la}. \tag{12}$$

This paper applies immersion theory to college English listening teaching, using virtual reality technology to create a three-dimensional virtual immersive environment for English listening teaching. The test of word form knowledge in the receptive vocabulary knowledge is mainly the second

item selection in the test paper after passing. This question mainly tests whether students can recognize the correct form of words from other interference options. Comparing the average correct rate of the experimental class and the control class on this question, it is found that the average correct rate of the experimental class is 65%, which is higher than 46% of the control class. The significance test also confirms that this difference is not accidental ($P = 0.03 < 0.05$). This shows that the tutorial case based on immersion theory can help students deepen the impression of vocabulary form. Although there is no special training for students' word forms in the immersive theory guide, the frequent appearance of vocabulary can deepen students' impressions of word forms. Therefore, the immersive theory guide is still useful for students' morphological memory. The predicted value is shown in Figure 5.

The examination of the word meaning knowledge in the receptive vocabulary knowledge is mainly carried out by the part of the first question in the posttest paper that writes the Chinese meaning of the word in English. This part of the test questions mainly examines whether students can accurately recall the meaning of words through word forms. The average correct rate of this question in the experimental class was 69%, while the average correct rate in the control class was 58% ($P = 0.01 < 0.05$). This shows that students' understanding and mastery of vocabulary meaning after using the immersive theory guide is better than that of the students who use the ordinary guide, that is, the immersive theory guide can effectively improve students' understanding of the meaning of words. This paper uses this new environment to promote English listening teaching, stimulate students' interest in English learning, and improve students' English the ability of listening.

It is worth noting that for the experimental class, the correct rate of English to Chinese (written in Chinese according to English words) and Chinese to English (written in English words according to Chinese meaning) is calculated separately for the experimental class: the correct rate of the first five English to Chinese is 69%, and the correct rate of the last five Chinese to English is 54%. This may be due to the immersion theory-based guidance plan trying to avoid direct connection between English and Chinese, not allowing students to understand English vocabulary through Chinese vocabulary, but allowing students to directly understand English words and establish a connection between English and real life. The correct rate from English to Chinese is higher than that from Chinese to English. It also shows that students' understanding of English words is not based on the direct connection between English and Chinese, but on the understanding of the meaning of the English words themselves. The evaluation is shown in Figure 6.

The test of the contextual knowledge of vocabulary use in the receptive vocabulary is conducted through reading comprehension in the fourth question in the posttest paper. This question requires students to understand and grasp the overall textual context and the context of the sentence where the word is located in the reading process and write the sentence meaning of the sentence where the word is located, so that the researcher can judge whether the student correctly understands the word where the word is located. In the context and the meaning of words in context, the average correct rate of this question in the experimental class was 57%, while the average correct rate of the control class was 40% ($P = 0.04 < 0.05$). This shows that the guided learning cases based on immersion theory are better than the ordinary guided learning cases in improving students' understanding of context, although this significant difference is marginal, thereby comprehensively improving the efficiency of English listening teaching and making college English listening lessons lively and interesting and rich in information.

In summary of the above three aspects, it is not difficult to find that the guided learning case based on immersion theory is more effective in improving the comprehensive receptive vocabulary knowledge of students than the general guided learning case; the three aspects of receptive vocabulary knowledge are considered separately, based on immersion theory. The guided learning plan has the best effect on improving students' understanding of the meaning of words.

The spelling of word forms in productive vocabulary knowledge is tested by writing out the correct form of words in the fifth question in the posttest paper. This question requires students to correctly fill in the missing letters in the word according to the content of the article and the hints given to test whether the student can spell the word correctly. The correct rate of the question in the experimental class was 58%, and that of the control class was 47% ($P = 0.04 < 0.05$). This shows that the guided learning plans based on immersion theory have a slight advantage over ordinary guided learning plans in improving students' vocabulary spelling. It also helps students have an immersive experience, so as to cultivate students' interest in learning, form learning motivation, and ultimately achieve the goal of improving their English proficiency.

The correct use of word meaning in productive vocabulary knowledge is tested by writing English words according to the Chinese meaning in the first question of the posttest paper. This question tests whether students can correctly choose the form of the word according to the meaning of the word, which belongs to the productive process from the meaning of the word to the shape of the word. The average correct rate of this question in the experimental class was 54%, and the average correct rate of this question in the control class was 46%. Although the average accuracy rate of the experimental class is slightly higher than that of the control class, the statistical test does not show significance, so it can only show that there is no significant difference between the guided learning case based on the immersion theory and the ordinary guided learning case in terms of the use of word meaning. The guided learning case based on immersion theory avoids establishing a direct connection between English and Chinese but allows students to directly understand English, so it is not significant for the conversion from Chinese to English, but at the same time, this way of directly understanding English can be better help students use vocabulary in appropriate context. The prediction is shown in Figure 7.

For the use of vocabulary in the productive vocabulary knowledge, the third question in the posttest paper is used
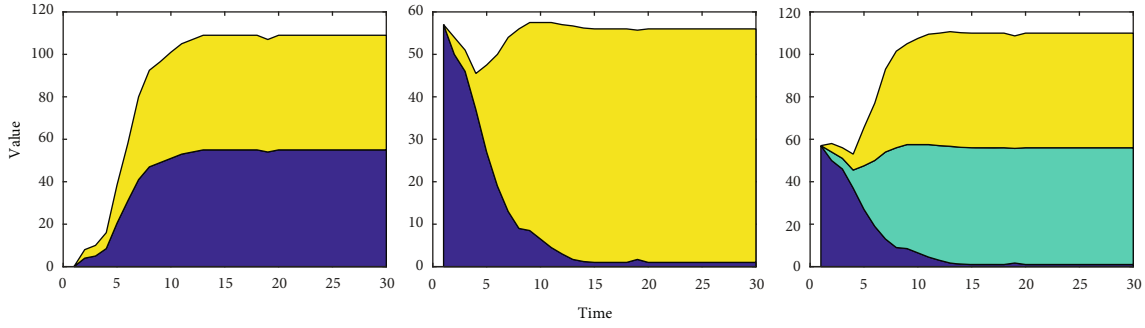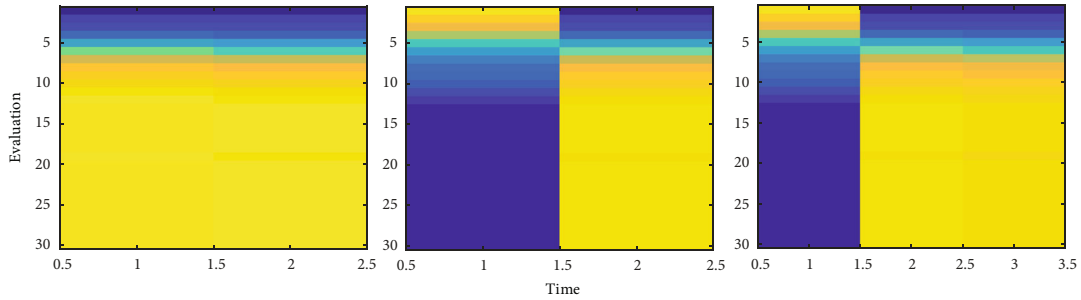
FIGURE 5: Predicted value.
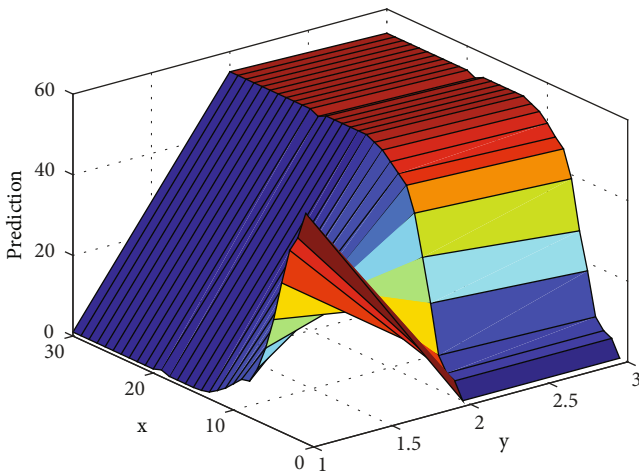

FIGURE 6: The evaluation.

FIGURE 7: Prediction.

to test the sentence. This question tests whether students can use vocabulary correctly and use them in a suitable context. The average correct rate of this question in the experimental class was 53%, and the average correct rate of this question in the control class was 39% ($P = 0.03 < 0.05$). This shows that in the correct use of vocabulary in a suitable context, the improvement effect of guided learning cases based on immersion theory is higher than that of ordinary guided learning cases. Thus, students can find problems through self-diagnosis and obtain effective guidance and intervention, finally helping them to move towards autonomous learning.

To sum up, the immersive theory guided learning case is better than the general guided learning case for the comprehensive improvement of productive vocabulary knowledge. Compared with the receptive vocabulary knowledge, the immersive theory guided learning case improves the receptive vocabulary knowledge. It is better than the improvement of productive vocabulary knowledge. In the productive vocabulary knowledge, looking at the three aspects of word form, word meaning, and usage separately, it can also be found that the guide case based on immersion theory is the most helpful for students to use vocabulary correctly in a suitable context. This is also the ultimate goal of modern English education. From this perspective, this research also helps to open up new directions for future English research.

According to Figure 8, looking at each option longitudinally, most people in the control class think it is difficult to learn vocabulary using ordinary tutorial plans to help them recall relevant vocabulary knowledge during reading, but there are still 20% of the students who believed that the ordinary tutorials can help them master receptive vocabulary knowledge. In the experimental class, many students think that the use of immersion theory-based tutorials for learning can help them quickly recall vocabulary knowledge in other English materials reading, but it should also be noted that 23% of the students does not obviously feel the help of using a tutorial based on immersion theory. From a horizontal perspective, the experimental class thinks that the proportion of the guided learning case that does not help the mastery of receptive vocabulary and knowledge is much less than the control class, and the proportion that thinks it is helpful is much greater than that of the control class. This
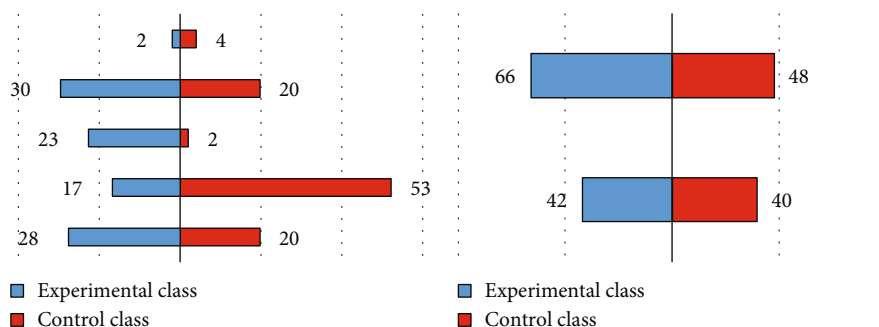
FIGURE 8: Option longitudinally.

shows that it is compared with the ordinary guided learning case. In other words, the guided learning case based on immersion theory has played a certain role in students' receptive vocabulary knowledge mastery.

This may be due to the fact that in students' daily English use situations, including class, and doing questions, the opportunity to use vocabulary knowledge for reading activities is greater than the opportunity for English writing, which makes it impossible for students to clearly feel and measure their vocabulary use in the writing process. In the writing process, students are often accustomed to applying typical examples that have been memorized or applying writing templates summarized in reference books, making students unwilling to spend energy using their own abilities and knowledge to think. Therefore, it is believed that the tutorial case is not very helpful to productive activities such as writing. Reading occupies a large proportion of students' various English learning activities, and students have to extract relevant knowledge when encountering words during the reading process, so they have a clearer sense of the use of vocabulary knowledge in the reading process. However, it can also be seen from Figure 8 that whether it is the mastery of receptive vocabulary knowledge or the mastery of productive vocabulary, the guided learning case based on immersion theory can provide relatively great help.

4. Conclusion

This paper applies immersion theory to college English listening teaching, using virtual reality technology to create a three-dimensional virtual immersive environment for English listening teaching and using this new environment to promote English listening teaching, stimulate students' interest in English learning, and improve students' English. The ability of listening comprehensively improves the efficiency of English listening teaching, thereby making college English listening lessons lively and interesting and rich in information, and helps students have an immersive experience, so as to cultivate students' interest in learning, form learning motivation, and ultimately achieve the goal of improving their English proficiency. The method proposed in this article organically integrates the teaching, learning, and evaluation of English listening. First of all, it can evaluate the attribute grasping mode and its advantages and disadvantages of groups and individuals in the process of lis-

tening and cognition. Relying on the network, it can also provide real-time networked diagnosis reports and targeted guidance. Secondly, teachers can discover the characteristics and needs of individuals and groups based on the diagnosis results, adjust and optimize their own teaching methods, and truly teach students in accordance with their aptitude. More importantly, students can find problems through self-diagnosis and obtain effective guidance and intervention, finally helping them to move towards autonomous learning. This is also the ultimate goal of modern English education. From this perspective, this research also helps to open up new directions for future English research.

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 they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgments

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