

Virtual Situated Learning of Spoken English Based on Computer Simulation Technology

<https://doi.org/10.3991/ijet.v15i04.12939>

Min Zhang

Beihua University, Jilin, China

1062868809@qq.com

Abstract—This paper aims to effectively improve the learning effect of spoken English, which is difficult to learn or practice. For this purpose, the 3D space was constructed by computer simulation and virtual reality (VR) technology. Then, the author designed a computer simulation software to create a 3D virtual learning environment, which is almost indistinguishable from the real world, for immersive learning of spoken English. A total of 100 students were selected to learn spoken English for 12 weeks in the virtual environment. The learning outcomes were collected and analysed by statistical and induction methods. The analysis results show that the virtual environment greatly stimulated the students' enthusiasm for spoken English learning, and improved the learning effect by 26~32%; the delay of the proposed software falls in the allowable range, but needs to be further improved. The research findings shed new light on the methods and theories of virtual situated learning of spoken English.

Keywords—Spoken English, computer simulation, 3D virtual environment, situated learning

1 Introduction

Spoken English is an important part of practical English learning [1]. For Chinese students, it's the largest barrier in English learning. According to the literature statistics [2], more than 78.2% of English learners is difficult to achieve normal oral communication; Chinese students can do well in writing, but not in listening and speaking, which is their current state of learning English. This is mainly due to the lack of effective communication environment and daily use environment in addition to the existing domestic learning and examination model [3]. Based on this, it's an important topic of study for many educationalists to improve the listening and speaking ability of English learners. Researchers and front-line teachers have been constantly attempting to apply the latest research results in science and technology to the English classroom, for the purpose of simulating a real English environment as much as possible [4]. Many scholars at home and abroad have proposed many countermeasures and methods from the two-dimensional space exchange, the introduction of foreign teacher resources, and the way out of the country [5]. However, there are still certain limita-

tions of the above methods, since they're only beneficial to a small group of learners, and most spoken English learners are difficult to achieve the above learning environment, resulting in insignificant effects on learners.

Despite of the previous two-dimensional learning style [6], this study uses the most advanced VR technology in computer science to simulate a 3D space [7, 8], enabling the spoken language learners to realize the real online communication of virtual environment without leaving home, and thus solving the problem of lack of real environment in English learning [9]. The programming-based simulation environment has certain limitations in technology and usage, that is, the delay of network transmission, which restricts the transmission of language, but realizes the natural experience and interaction in virtual world [10]. The research findings provide a way of thinking and method for the majority of oral learning researchers, and lays a foundation for further research on the application of VE technology in spoken language teaching.

2 Development of Spoken English Virtual Situated Learning Method Development Based on Computer Simulation Technology

Based on JAVA software, component technology simulator, many years of teaching practice in spoken English teaching, and the summarized successful teaching experience model, this paper develops a 3D virtual immersive simulation model of spoken English learning [11]. Through programming the standard components of the verification object, and importing process of social interaction, it can easily realize the interchange of different dimensions. According to the literature [7], the PC hardware of the P63.2G, 2G memory were applied in this study.

2.1 Establishment of a virtual situated learning theory model based on computer simulation technology

Figure 1 shows the process design of oral English learning activities in a virtual environment. The whole process includes preliminary design of learning activities, design of learning tasks, process design of learning activities, evaluation design of learning activities and monitoring design of learning activities. To establish the model based on computer simulation technology, the deployment of simulation software modules, and the design framework were determined firstly. Our model was established based on related literature, and the software development was completed with the aid of the computer college [12,13]. Thus, only the model modules were discussed in this study, excluding the software technical level [14]. The model mainly consists of the registration authentication management, guiding module, user modules (teacher, student, session group management, voice transmission, file release, file server and research searching), and file server and index evaluation module [15]. Figure 2 shows the specific model diagram for the specific use function and operation method (model actual operation available) of each module.

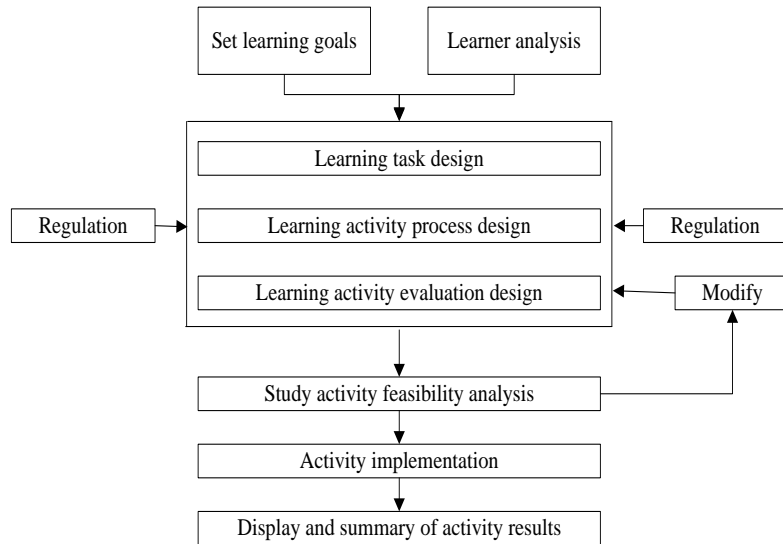


Fig. 1. Process design of oral English learning activities in virtual environment

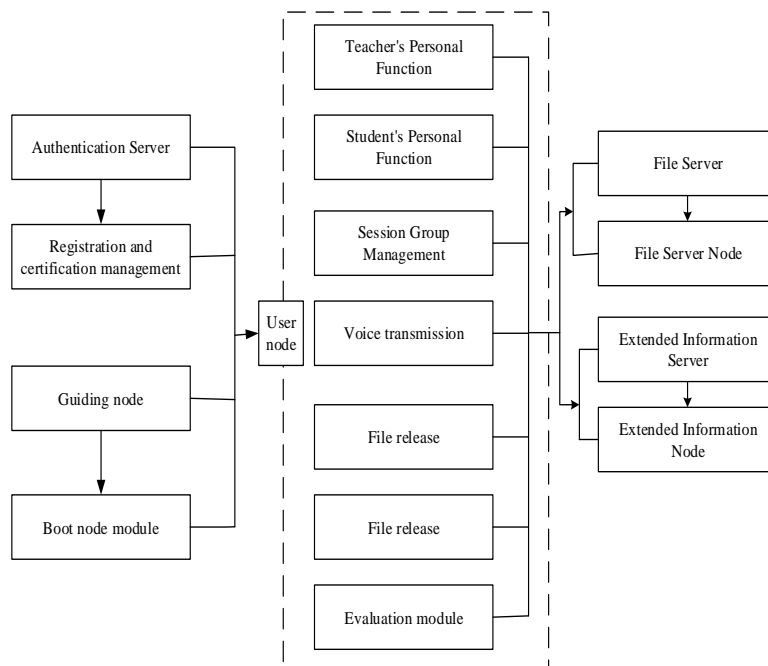


Fig. 2. Virtual software model deployment

3D virtual situated learning classroom design of spoken English: For the smooth development of virtual immersive spoken English learning, it is necessary to design a relatively complete situated classroom in addition to the establishment of the

interactive model [16]. Such a virtual teaching model can reduce the limitations of insufficient teachers and teaching venues, enrich teaching content and practice, and thus provide more learning opportunities for spoken language learners. Under the premise of situated learning model design, the virtual situated learning classroom in this paper can reduce the requirements of the central server through computer technology, and the users make communication in the authentication server on the established platform. On this platform, it can be seen that a large amount of user information collected by the model is distributed and stored in the network, which is conducive to realizing real-time learning and teaching, as shown in Figure 3. Since the PSP technology etc. was implanted into the model in advance, the classroom server could avoid the maintenance of a large amount of user information, and had no over-high requirements for the server. This facilitates the real-time teaching, single practice, multi-person or double-learning forms, achieves performance evaluation, and also helps to well manage the course information through the background monitoring.

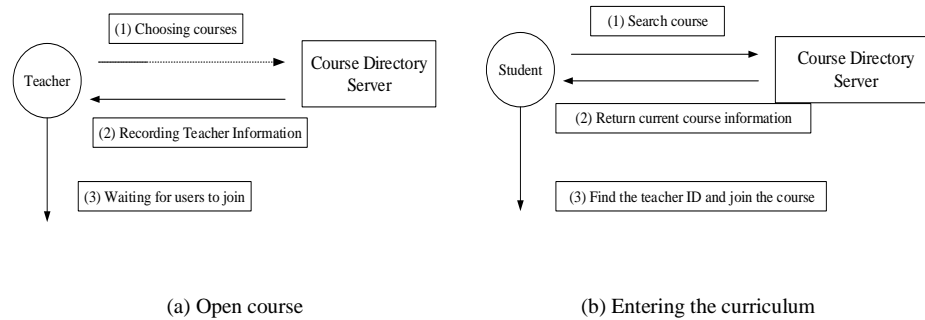


Fig. 3. Real-time teaching process

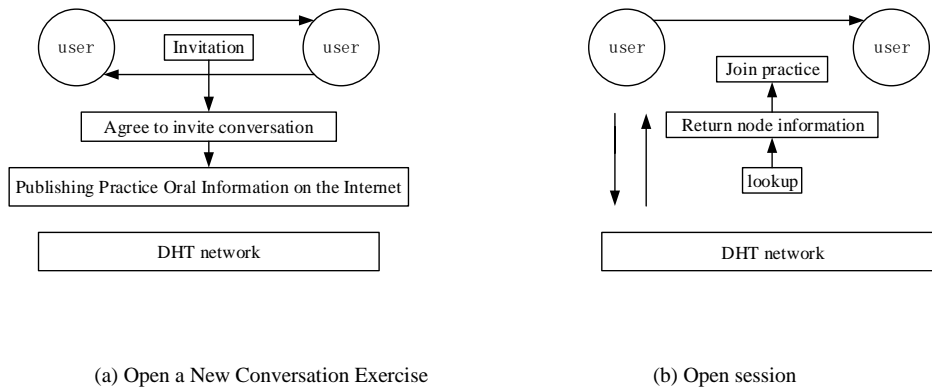


Fig. 4. Multi-person exercise module

After the students practice according to the above-mentioned operation process, the system will ask the user to apply and evaluate their self-learning effect in the specified

exercises. Through the virtual network platform, the user will be linked to the server embedded in the English-speaking client, and then open a conversation using the speech system, so that the knowledge of learning can be quickly switched and applied. Figure 4 shows the user's use process. After the user completes the practice and evaluation, they search for the address of the relevant extended information server through the network, communicate with the server, and then submit the practice recording and evaluation results. If the server is temporarily unavailable, the user node will save the result and upload it later. When the node accesses the server as a student, the teacher's communication and student dialogue can be used to indicate the voice and intonation problems in the learning process, so that the students can understand their own learning situation in real time and dynamically adjust their methods and plans. When the node accesses the server as a teacher, it can randomly extract the recording results and related evaluations of any student's practice, and query the students' overall evaluation and other data formed by a certain exercise, so as to achieve the supervision of students' progress, the students' feedback on the course, the examination of the individual students' learning situation, etc. The operation process is shown in Figure 5.

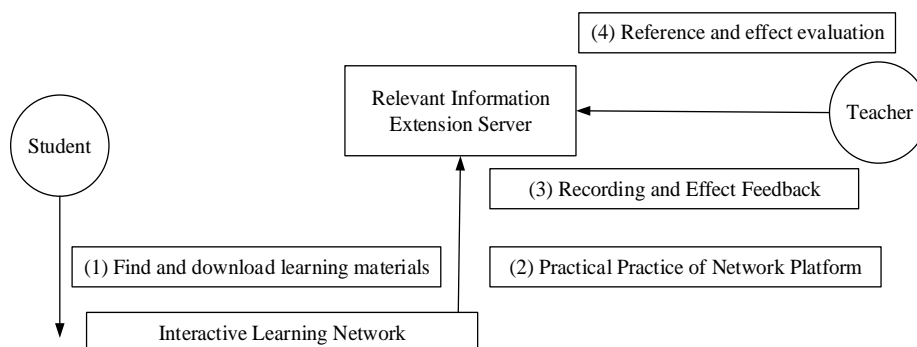


Fig. 5. The process of the evaluation phase

3 Effect Verification and Analysis for 3D Virtual Situated Learning of Spoken English

3.1 Research process of 3D virtual situated learning of spoken English

Based on the above simulation technology, the author designed a spoken English learning model and learning classroom. The students from non-English majors and the spoken English training agency were selected for practice teaching, and divided into two classes respectively. There were 30 students/class in non-English majors, for a total of 60 students; 25 learners/class from the training agency, for a total of 50 students. They were tested to be in the same proficiency of spoken English before the experiment. This 12-week experiment was planned to verify whether the computer simulation technology software designed in this paper is feasible, find out and solve

the problems, and design the teaching activities (Table 1). According to the learning plan listed in Table 1, it tracked the learning situation of the students, and then the students accessed into the learning network through the nodes of simulation technology after determining the design of the teaching plan (i.e., the teaching link).

Table 1. Learning plan follow-up table

Time	Learning arrangement						
	Technical training	Teacher guidance	Dialogue practice	Thematic activities	Classroom interaction	Foreigner Exchange	Effect evaluation
1 week	√						
2-3week		√	√		√		√
4-5week		√		√	√		√
6-12week		√		√	√	√	√

The communication was fulfilled according to the program and the authentication server. With the authentication completed, the users could acquire any online user list in the current network from the guiding node, and publish its own users to the network, so that the other users obtain its address by searching for this user. The related process is shown in Figure 6. After the user joined the network, they can perform lectures, attend lectures, exercises, etc. as required. After finishing all node, the class was taught in real time. According to the steps described in 2.2, students can choose the learning mode they want, click to enter for study, select the preferred situation for online spoken English learning and exercise, and finally perform the evaluation.

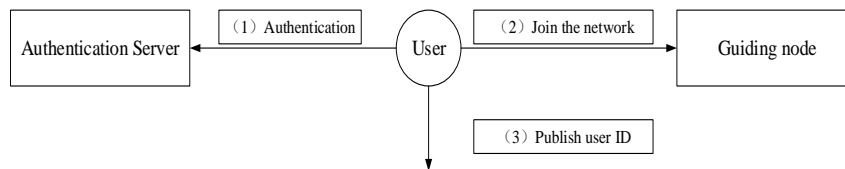


Fig. 6. Nodes join the network

In view of the practicability and authenticity of the evaluation results, this paper performs statistical analysis on the characteristics of the test respondents, and gives better feedbacks about the research results according to different background data and learning conditions of the respondents. Table 2 lists the basic information of the respondents.

Table 2. Summary of basic information of respondents

Index	Division level	Sample size	Percentage
Gender	Male	63	57.3
	Female sex	47	42.7
Educational level	Junior college and below	40	36.4
	Undergraduate	52	47.3
	Master degree or above	18	16.3
Learning life	Less than 1 years	14	12.7
	1-3 years	45	40.9
	3-5 years	34	30.9
	More than 5 years	17	15.4
Age range	18-22	52	47.2
	22-25	29	26.4
	25-30	19	17.3
	≥30	10	9.1

3.2 Effect verification and analysis for 3D immersive virtual situated learning of spoken English

From the three-dimensional perspective, the established simulation learning platform is designed for interactive multicast applications. In the actual use process, the delay of the information received by the nodes should be analysed. The delay of the node processing used in this paper fall in the range of 20-40s. Through detailed analysis of its delay, it's convenient for the background monitoring system, teachers, etc. to find the accuracy of the transmitted voice and the degree of student's response to the language transmission in the virtual learning platform respectively, which help to better guide and master the effect of student learning, and then improve the virtual platform. Figure 7 shows the follow-up trend of delay and voice data monitoring.

Based on the transmission error of the virtual platform, the actual learning effect of the respondents was analysed, and the delay tracking data of data transmission was established. From the trend graph of Figure 7, it can be seen that the delay of the data transmitted by the established software platform is in the allowable range. But as the number of data transmission points increased, the delay was on the rise, which may affect the learning effect and the resolution of the speech. Therefore, it can be the focus of the next stage to reduce the delay for the improvement of the virtual platform. Within the effective range, the transmitted data simulated in this paper is implementable.

The two classes (the class of non-English majors, and that training agency learners) were divided into two groups according to the actual experimental process respectively the experimental group and control group. Under the virtual spoken English learning environment, students used the substitute to overcome the shyness. But at the beginning, technical problems (such as being unfamiliar with the interface of multi-user environments) and professional issues made students be prone to frustration, lack of confidence and sense of achievement. Students need to be first led by a teacher and then transited to a group or independent activity. The whole activity should be stu-

dent-centred, without ignoring the guiding role of teachers. After 12 weeks of planned study, their final learning effect was evaluated to obtain the results as shown in Figure 8. It can be seen from Figure 8, the average score of the experimental group was 26-32% higher than that of the control group; for the 90-100 scores, the number of learners of training agency were higher, because of their interest in oral learning and the significant learning effect of the virtual platform, while the college students of non-English major also showed that the experimental improved more than the control group, occupying a larger proportion.

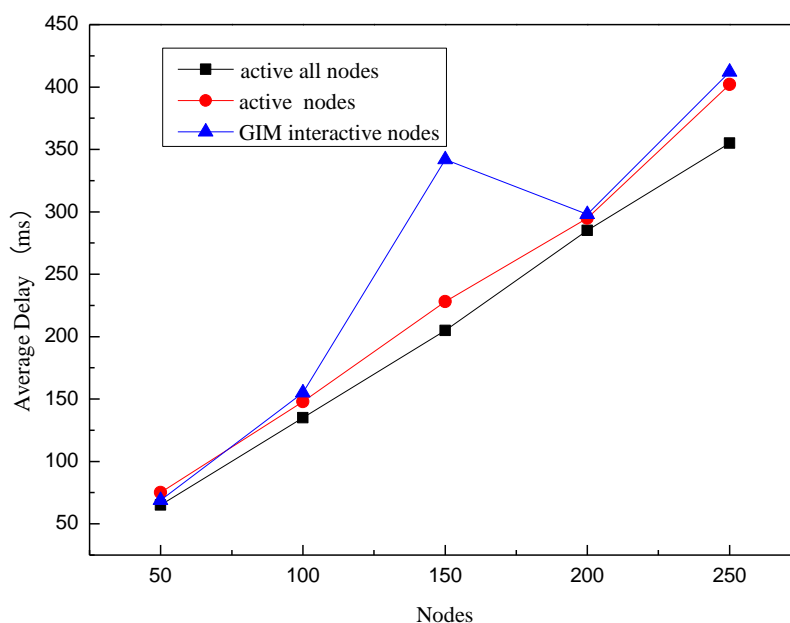


Fig. 7. Delay and voice data monitoring implementation follow-up trend chart

In addition to the tracking survey on the respondents using the questionnaires, this paper also conducts survey for English majors, non-English majors, social users, and general public on their concerns about spoken English learning in the virtual situation. The survey found that for different types of people, they all were most concerned about the communication content, followed by the timeline of learning; their concerns about the learning feedback, the communication object of the virtual platform, and the communication mode were relatively high, as shown in Figure 9, which provides theoretical support for the construction of the virtual situated learning platform.

Figure 10 shows the situation satisfaction of English learning activities. It can be seen that 70% of English learners are satisfied or very satisfied with the situation. As above, compared with the current mainstream online courses, oral language course has more obvious characteristics and special requirements. Opening the oral language course on line without thinking or directly applying the existing network teaching mode will damage the virtual situated teaching effect of the spoken language. There-

fore, it is necessary to further explore the theoretical key issues of online teaching. Subsequent research and recommendations were analysed in 3.3 below.

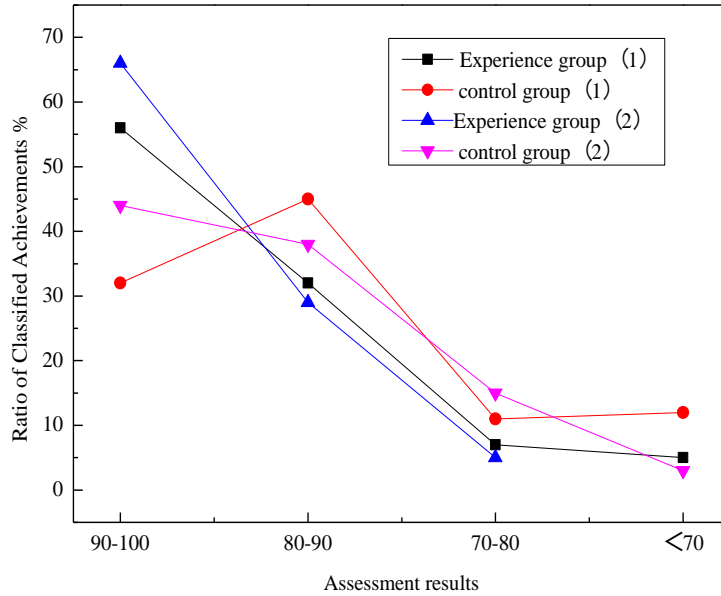


Fig. 8. Tracking the learning effect of the respondents

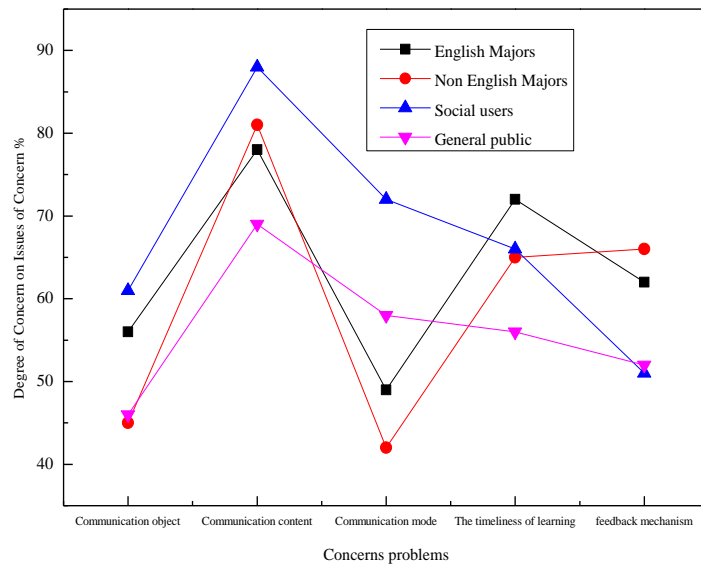


Fig. 9. Survey and practical operation analysis of different learning objects' concerns about the platform

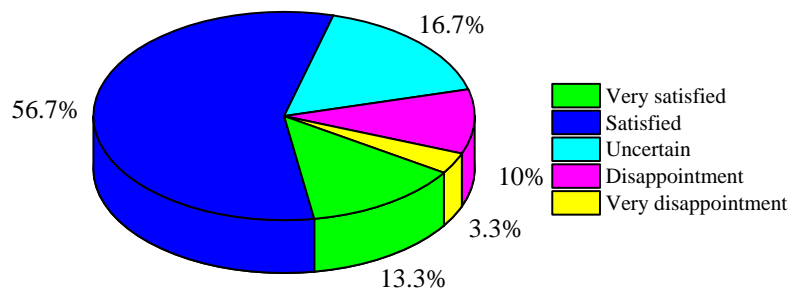


Fig. 10. Situational satisfaction of English learning activities

3.3 Recommendations for 3D immersive spoken English virtual situation learning

As a brand new teaching method and concept, the three-dimensional immersive virtual situational teaching of spoken English has achieved certain results through the practical verification in the above research process, but due to the differences in design characteristics and the teaching objects of the situational teaching course, the existing situational teaching needs continuous improvement to cope with the changeable teaching mode and methods. First, the continuous research needs to combine the theory of online teaching, and try to analyze the teaching mode and the type of interaction required in the special context of spoken English virtual classrooms according to the current teaching situation and actual demands of spoken language teaching. Next, it's also necessary to deeply compare and analyze the resource search mechanism of the network, further refine the research on the verification of the teaching results according to the actual needs of the spoken virtual classroom, select the part of resource search and positioning, and then study how the virtual classroom realizes the user positioning and search based the characteristic environment of the model, striving to achieve the prototype of the voice communication module. A further exploration should made to study the delay problem in the background of speech group communication application, and compare the methods of interactive application layer in terms of the performance index for delay, thereby improving the application of virtual classroom. Finally, the simulation model mentioned in the previous research should be used to verify the validity of the established curriculum model.

4 Conclusion

This paper establishes a virtual model of spoken English learning based on the computer simulation technology. The data tracking method was used to analyse the application of virtual software, and 110 respondents were selected to learn spoken English for 12 weeks in the virtual environment. Finally, the five main concerns in the virtual platform construction were obtained through investigation and induction. The specific conclusions are as follows:

- The virtual platform has certain limitations in the application process of teaching, especially the technical bottlenecks. The data transmission delay of the virtual platform is within the controllable range, but it is currently limited to large-scale group;
- Multi-sensory virtual platform is a promising English-assisted teaching tool. It has a significant practical effect, that is, the students using this learning platform improved their scores by 26-32% compared with non-users, especially for those with the scores of 90-100. Thus, it is worthwhile to continuously dig its value, explore a rich and varied teaching content on the virtual platform, and constantly develop the virtual English learning model;
- Through the survey and induction method, it's found that the learners' most concern about the construction of virtual English-speaking platform was the content of communication, so the enrichment of spoken English teaching content and construction of classified themes are the primary concern of virtual platform. Then, the other concerns were ranked from high to low: the timeliness of learning timely feedback mechanism, platform-selectable virtual communication objects and communication mode.

5 Acknowledgement

Social & Scientific Foundation of Jilin Province (Merging Discourse System between China and Abroad under the view of Introduction Chinese Culture 2019wt37).

6 References

- [1] Zhang, H. (2013). Pedagogical challenges of spoken English learning in the second life virtual world: a case study. *British Journal of Educational Technology*, 44(2). <https://doi.org/10.1111/j.1467-8535.2012.01312.x>
- [2] Chandrasekaran, B., Kraus, N., Wong, P. C. M. (2012). Human inferior colliculus activity relates to individual differences in spoken language learning. *Journal of Neurophysiology*, 107(5): 1325-1336. <https://doi.org/10.1152/jn.00923.2011>
- [3] Plough, I. C., Briggs, S. L., Bonn, S. V. (2010). A multi-method analysis of evaluation criteria used to assess the speaking proficiency of graduate student instructors. *Language Testing*, 27(2): 235-260. <https://doi.org/10.1177/0265532209349469>
- [4] Liang, Y., Xu, J. (2013). An Intelligent Tutoring System Based on Speech Assessment for Spoken English Learning in China. *International Conference on Brain Inspired Cognitive Systems*. Springer, Berlin, Heidelberg, 16(2): 48-53. https://doi.org/10.1007/978-3-642-38786-9_40
- [5] Zhang, Y., Jia, L. Y., Hu, J. Y. (2013). Design and validity study on oral English assessment in graduate students. *Academic*, 2: 249-253. <http://dx.doi.org/10.3969/j.issn.1002-1698.2013.02.025>
- [6] Liu, S., Yang, F., Wang, S. X., Chen, Y. (2018). Automatic generation of bas-relief on 3D models based on 2D images for rhinoceros. *Ingénierie des Systèmes d'Information*, 23(6): 99-113. <https://doi.org/10.3166/isi.23.6.99-113>

- [7] Lu, X. Z., Yang, N., Jiang, J. J. (2004). Application of computer simulation technology for structure analysis in disaster. *Automation in Construction*, 13(5): 597-606. <http://dx.doi.org/10.1016/j.autcon.2004.04.002>
- [8] Wu, Q. S., Meng, P., Liu, G. (2018). Reconstruction of 3D building model based on the information in floor plan. *Traitement du Signal*, 35(3-4): 303-316. <https://doi.org/10.3166/ts.35.303-316>
- [9] Liu, C. H., Huang, Y. M. (2015). An empirical investigation of computer simulation technology acceptance to explore the factors that affect user intention. *Universal Access in the Information Society*, 14(3): 449-457. <https://doi.org/10.1007/s10209-015-0402-7>
- [10] Proserpio, L., Gioia, D. A. (2007). Teaching the virtual generation. *Academy of Management Learning & Education*, 6(1): 69-80. <https://doi.org/10.5465/amle.2007.24401703>
- [11] Guasch, T., Alvarez, I., Espasa, A. (2010). University teacher competencies in a virtual teaching/learning environment: analysis of a teacher training experience. *Teaching & Teacher Education*, 26(2): 199-206. <https://doi.org/10.1016/j.tate.2009.02.018>
- [12] Russell, M., Andrew, C., Calbert, G., Paula, B. (2015). Incremental Dependency Parsing and Disfluency Detection in Spoken Learner English. *International Conference on Text, Speech, and Dialogue*. Springer International Publishing, 9302: 470-479. https://doi.org/10.1007/978-3-319-24033-6_53
- [13] Natsumi, M., Kiyoko, Y. (2015). Foreign accentedness of English sentences spoken by Japanese EFL learners and Japanese teachers of English: a first report. *Journal of the Acoustical Society of America*, 138(3), 1946-1946. <https://doi.org/10.1121/1.4934155>
- [14] Peyghambarian, F., Ashraf, H., Fatemi, M. A. (2014). The effect of "go English me", a virtual learning website on lower intermediate Iranian EFL learners speaking ability, 5(6), 234-238. <https://doi.org/10.7575/aiac.all.v.5n.6p.234>
- [15] Yao, Y., Pei, G. H., Liu, B., Wang, Y. B. (2014). Computer simulation technology in architectural design applications. *Advanced Materials Research*, 971-973, 2076-2079. <https://doi.org/10.4028/www.scientific.net/amr.971-973.2076>
- [16] Hu, X. P., You, Z. P. (2015). Computer simulation technology application in hydraulic system analysis and design. *Advanced Materials Research*, 756-759, 4444-4447. <https://doi.org/10.4028/www.scientific.net/amr.756-759.4444>

7 Author

Min Zhang, is an associate professor, master of Foreign Linguistics and Applied Linguistics, excellent English teacher of Foreign Languages College of Beihua University. Zhang has published several articles in Chinese core journals, led several projects of teaching innovation, and writing several books on English education.

Article submitted 2019-12-13. Resubmitted 2020-01-05. Final acceptance 2020-01-07. Final version published as submitted by the authors.