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Teaching Liberal Education Using Virtual Reality
A Case Study of a Spanish Culture Course

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ABSTRACT
With the development of virtual reality technology, the opportunity of using virtual reality to assist teaching has received much attention from numerous scholars and experts. This paper discusses the methods, advantages, and challenges of adopting the virtual reality technology in the university's liberal education courses. It includes an in-depth review of similar studies and covers two major theories about knowledge acquisition, namely, Constructivism and Flipped classroom. This paper also uses the course: "Overview of Spanish-speaking Countries" as an example to explain the feasibility, advantages, and possible challenges in using virtual reality to teach Spanish culture. During the explanation, the idea of the VR-based Spanish culture learning platform is also presented. This research should provide insights into the virtual reality education field about the way to adopt virtual reality in university's liberal education courses and provide a solid foundation for further research and practice.

Keywords: *Teaching mode, Virtual Reality, Flipped Classroom, Liberal education courses.*

1. INTRODUCTION

Virtual Reality (VR) is a technology that integrates system simulation, computer graphics, digital image processing, and sensing and measurement to create a high perceptible simulation environment. VR technology has three fundamental characteristics, namely, immersion, interaction, and imagination ("Figure 1") (Burdea and Langrana 1992). Stereo-capable monitors with desktop tracking, Cave automatic virtual environment (CAVE) system, and VR head-mounted displays (HMD) are typical examples of VR devices (Berg and Vance, 2017). With VR, users can immerse themselves in a 3D virtual world that looks very similar to the real world. They can walk freely inside and interact with the virtual objects or characters to accomplish missions that would be otherwise hard to be performed in the real world [Kwok, Yan, Qu, Lau, 2020]. This feature makes VR a useful tool for enriching teaching methods, stimulating students' interest, and improving teaching effects in the education field. [Kwok, Yan, Chan, Lau, 2019].

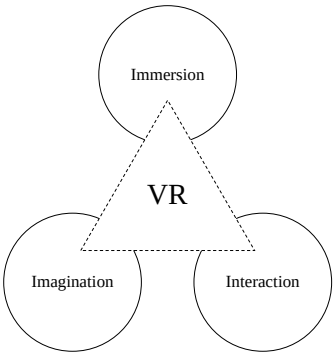

Figure 1 Virtual reality triangle (Burdea and Langrana 1992).

Therefore, VR education has received strong support from the Chinese government. As early as 2012, the *Thirteenth Five-Year Plan for the Development of National Education Development* stated the importance of promoting the in-depth integration of information technology and education and the new modes of education and teaching with the comprehensive use of Internet, Big Data, artificial intelligence, and VR

technology; in 2015, the State Council also issued the *Guiding Opinions of the State Council on Promoting Actively the Internet Plus Action*, which proposed to apply Internet-related technologies for reform in various fields including education; in 2018, the Ministry of Education with other five departments published the *Education Revitalization Action Plan (2018-2022)*, which pointed out the necessity of promoting the construction of virtual simulation laboratories and the application of VR technology in classes, in order to promote the reform of teaching methods characterized by independence study, cooperation, and active exploration; this goal was once again emphasized in the *Key Points of Education Informatization and Cybersecurity Work in 2019* issued by the Ministry of Education in 2019. In summary, the application of VR technology in the education field has received significant attention from the Chinese education sector and has become a hot spot and priority task in developing education reform in the new era.

Liberal education plays a vital role in higher education. According to the definition of the Association of American Colleges & Universities in the United States, liberal education is a philosophy of education that empowers individuals with broad knowledge and transferable skills, and a stronger sense of values, ethics, and civic engagement ... characterized by challenging encounters with important issues, and more a way of studying than a specific course or field of study (AAC&U, 2020). In China, liberal education has a relatively short history. In 2000, Peking University started to offer a liberal education curriculum to its undergraduate students, followed by other institutions throughout the country (Xin, 2004, pp. 1-2). Traditional liberal education attempts to expand students' intellectual horizons and improve their abilities towards challenges. It focuses more on long-term personal development instead of short-term benefits such as finding jobs. Hence, liberal education is often discouraged by students (Axelrod, Anisef, & Lin, 2001). Therefore, compared with professional courses, liberal courses are more in need of teaching reform to increase their attractiveness, activate students' interest in learning, improve teaching effects, and finally achieve the established course objectives.

The "Overview of Spanish-speaking Countries" is an elective course open to all undergraduates at the Jinan University. It aims at helping students to have a primary contact with the history, culture, politics, and economy of the Spanish world, including Spain and Latin America. It allows students to understand the relative position of Chinese civilization in the world cultural system while feeling the diversity and richness of the world cultural system. The course aims at equipping students with the ability to appreciate and tolerate the cultures of other nations and helping them to become "world citizens" who can resolve cultural conflicts and promote world harmony.

This paper involves four sections: following Section 1, the introduction, similar works are discussed in Section 2. The theoretical foundation of this study is provided in Section 3. The proposed teaching methodology, together with a discussion on its advantages and challenges, is presented in Section 4. Lastly, a conclusion is drawn in Section 5.

2. OVERVIEW OF THE APPLICATION OF VR IN THE EDUCATION FIELD

VR technology enables people to enter and experience things inside an artificial virtual world at any time and space. This feature of VR technology makes it a useful tool for learning. Hence, increasingly more researchers started exploring the feasibility of using VR for teaching and education.

Clinical medicine is the earliest and most widely used field of VR technology to assist teaching. Researchers in this field usually construct a simulated surgical operating room, where medical students can do invasive operations to an avatar inside such a virtual operating room. The VR training can help students to have a better understanding of human anatomy, improve their proficiency in surgical operations, and understand the importance of teamwork (e.g., Alaker, Wynn, & Arulampalam, 2016; Jang, Vitale, Jyung, & Black, 2017; Khor et al., 2016; Moglia et al., 2016; Moro, Stromberga, Raikos, & Stirling, 2017; Pelargos et al., 2017; Yang, 2016).

Engineering is another field where VR education commonly applies. With the help of VR technology, students can learn and practice unfamiliar skills in a realistic environment without contacting risky or costly environments. Therefore, a large number of scholars have discussed the possible application of VR technology in engineering, laboratory skills, and military training (Alhalabi, 2016; Bhagat, Liou, & Chang, 2016; P.

K. Kwok, Bill K. P. Chan, and Henry Y. K. Lau; Wang, Wu, Wang, Chi, & Wang, 2018)

Besides the two mentioned fields, second language learning is also a field where VR technology can help. Social context is a vital element for foreign language acquisition. One cannot truly acquire the language without understanding the social and cultural connotations (Jiang Zukang, 1999; Wang Zuoliang, 1984, p. 2). In traditional foreign language learning, if students want to enter the target language's context, they should either travel abroad or interact with foreign teachers from the target language countries. Both methods have their respective limitations on time, space, or cost. Because of this limitation, VR is seen as a useful tool for foreign language acquisition as it can provide the target language's context at a low cost. Students can develop cross-cultural communication abilities in the simulated context by only putting on their VR HMDs. For this advantage, increasingly more scholars are studying the possibility of using VR for foreign language acquisition. For example, Chou Xinyi (2006) discussed the mode of application of VR technology in teaching Chinese as a foreign language. Zhou Xiaojun (2006) studied the path of the VR scene modeling, focusing on Chinese children's language learning. Ma Chongyu and Chen Jianlin (2012, 2013; 2009) proposed a foreign language teaching system based on VR technology. Zhang Ning (2017) analyzed the application of VR technology in a course named the English for Specific purposes (ESP), using the example of the shipping industry. With the continuous evolution of VR technology, there is an increasing need to explore the possibility of adopting VR in different subjects and courses.

3. THE THEORETICAL FOUNDATIONS OF APPLYING VR TECHNOLOGY TO LIBERAL EDUCATION

3.1 Theory of Constructivism

The constructivism — linked with Jean Piaget's theory of cognitive development, is a theory in education that recognizes the learners' understanding and knowledge based on their own experiences before entering school (Nola & Irzik, 2006, p. 175). In this perspective, learners are not passive knowledge receivers, but active knowledge discoverers. The learning behavior can be understood as a process in which learner uses the necessary learning materials under the social and cultural background to construct new experiences and gain knowledge. Relatively, liberal education courses focus more on knowledge dissemination and less skill training. According to this theory, the experience construction is the unique path through which the student can realize the interiorization of the knowledge.

3.2 Flipped Classroom

A flipped classroom is an instructional strategy and a type of blended learning which focused on student engagement and active learning. It gives instructors a better opportunity to deal with varied levels, student difficulties, and differentiated learning preferences during the in-class time (Ozdamli & Asiksoy, 2016). Sams and Bergmann (2013) believe that the key point of "flipped classroom" lies in the more effective use of classroom interaction time. Teachers, as experts in the specific fields, should encourage students to learn basic knowledge on their own, while using the interaction time to solve students' problems and help them to develop high-level capabilities. Also, in this digital era, with infinite accesses of the Internet, flipped together with information technology can allow students to take the initiative to explore their interests, find answers to questions, and enhance teamwork spirit through cooperation (Jin et al., 2019).

4. APPLICATION OF VR TECHNOLOGY IN LIBERAL EDUCATION COURSES

4.1 Construction of VR Environment Platform

The VR-based Spanish culture learning platform aims at providing students a convenient and enjoyable way to experience Spanish culture. It is hoped that the platform can raise students' interest and enthusiasm in "Overview of Spanish-speaking Countries". "Figure 2" is the concept of the VR-based Spanish culture learning platform. In detail, the VR-based Spanish culture learning platform provides a simulated environment for students to improve their understanding of Spanish culture, including Spanish's historical monuments, events, and social lives. The virtual scenes are captured using panoramic cameras, built using the Unity3D editor, and programed using C#. An interactive audio guide is also provided in the system so that students can have a better

understanding of the things being viewed. After putting on the VR HMD devices, students can enter the virtual scenes and start their self-learning experience. For example, they can explore the historical monuments following the audio guide and complete the missions or quizzes in between.

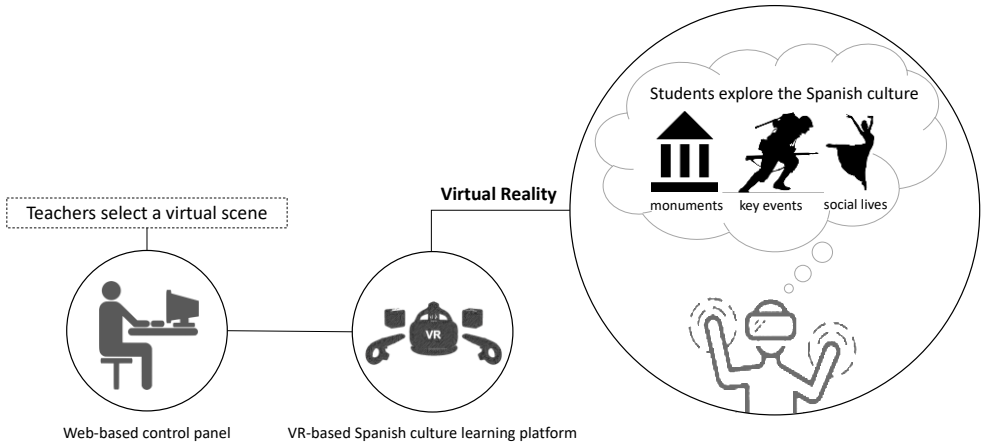

Figure 2 The concept of the VR-based Spanish culture learning platform.

Compared to off-the-shelf products such as Second Life, this VR-based Spanish culture learning platform should provide the following advantages:

- As the platform is made in-house, teachers can actively change the content of the virtual world and monitor students' behavior, thereby avoiding the existence of pornographic, violent, and other inconvenient factors;
- This platform is equipped with a comprehensive learning management module which can record and guide the learning process of the students. As such, teachers can evaluate and adjust their teaching speed based on students' performance.

4.2 Application Methods and Cases

With the VR-based Spanish culture learning platform, teachers can bring different interesting moments and architectures of the Spanish culture in the course based on their needs. According to the course content of "Overview of Spanish-speaking Countries", the platform should include the following four scenarios, namely, historical monuments and geographical environment, key historical events, social lives and traditional customs, and cultural products.

4.2.1 Historical Monuments and Geographical Environment

Historical monuments and geographical environment are essential modules of "Overview of Spanish-speaking Countries". In the traditional teaching model, teachers used to use pictures or videos to assist their explanation. Due to the lack of a sense of in-situ, such explanations often fail to leave a profound impression on students. In contrast, using VR technology, students can have a chance to immerse themselves in a highly replicated virtual scene and experience the architectures and geographical environment of various Spanish-speaking countries and nations from a first-person perspective. Take the Roman aqueduct in Segovia as an example. It would be very abstract and obscure to describe such a majestic building only by words and a few pieces of pictures. Students can not feel the grand scale of the aqueduct due to the lack of comparison. However, with VR technology, students walk around the aqueduct, allowing them to experience in person the glorious historical and cultural heritage that the Roman Empire left to Spain.

4.2.2 Key Historical Events

The world in which we live today is shaped step by step by our history, while the so-called "history" is composed of infinite historical events. In traditional classes, teachers used to present historical events orally together with pictures or video clips. This teaching method makes students

difficult to imagine and have a shock feeling on the historical events, which reduces the interest of the students in knowing such events. This limitation can be solved using VR technology. With VR, students can observe or even join the historical events from the first-person perspective. This experience can strengthen students' understanding of history. It can also stimulate students' reflective thinking about the events.

4.2.3 Social Lives and Traditional Customs

There are myriad differences between the Eastern world and the Western world regarding their culture, language, history, and geography. Hence, people from Eastern countries may have different behavior and attitudes of people from Western countries. Hence, it may be difficult for students to understand the social lives and traditional customs of Spanish-speaking countries without getting to those countries. With the help of VR technology, the conventional classroom can be effectively flipped, converting students from passive knowledge receivers to active knowledge discoverers and experiencers. For example, when the teacher explains the Easter Week (Semana Santa), an important religious holiday in the Spanish-speaking world, students can immerse themselves in the scene of Easter Week and participate in the grand procession. As such, students can have an embodied feeling of the important role that Catholicism plays in the social life of Spanish-speaking countries.

4.2.4 Cultural Products

Cultural products refer to the artworks, music, dance, architectural art, and literary works of the Spanish-speaking countries. They are often overlooked in traditional courses, as teachers may find it hard to describe them literally. Worse still, due to the lack of guidance from teachers, students may not have much motivation to find extra information after class. However, with VR flipped classrooms, teachers can directly show these cultural products in front of the students. Students can appreciate these cultural products closely in virtual galleries, cinemas, concert halls, libraries, lecture halls, museums, and other institutions. For example, after wearing the VR HMDs, students can enjoy flamenco dance with different virtual audiences in a virtual theater located in Seville. The environment with the style of southern Spain, the cheers of virtual audiences, and fantastic music should stimulate students' interest in learning foreign cultures. It is worth pointing out that this goal is difficult to be achieved in traditional classrooms. This embodied experience can drive students to take the initiative to study and explore relevant knowledge independently after classes.

4.3 Challenges and Suggestions

Although VR technology can provide many advantages to the liberal education courses, as it is still an emerging technology, its application still faces many challenges:

4.3.1 Multidisciplinary Coordination and Cooperation

VR education is a complicated process that requires the cooperation of teachers, 3D modelers, programmers, and educational psychologists. Teachers are responsible for designing and synthesizing the course content and the teaching objective. Based on the requirements from the teachers, the 3D modelers need to build the 3D model, including producing the textures of the model. At last, the programmers need to program the model to make the model intractable. For example, they may need to set up missions and quizzes inside the virtual scenes. On the other hand, when putting the model in practice, education psychologists may need to evaluate students' acceptance of this brand-new teaching method. After the evaluation, teachers may need to modify or redesign the details of the virtual scene based on students' reflections. Therefore, in this gradual process, experts from different disciplines must communicate, negotiate, and cooperate to achieve the most optimized teaching method.

4.3.2 Coordination and Integration of VR Simulation and Teaching Management System

In the flipped classroom model, learning is composed of formal lectures and learning activities. To maximize the effect of VR education, it is better to integrate the learning platform into the teaching management system. As such, teachers can have better control over the teaching progress, improve students' learning efficiency, encourage self-learning, and quantify students' performance.

4.3.3 Training of Teaching Strategies and Skills

Compared with the traditional passive teaching mode under the guidance of behaviorism, VR education emphasizes on the activeness of the students. In terms of teaching strategies and skills, teachers should encourage students to learn actively, guide students to discover problems on their own, create a productive classroom and extracurricular learning mechanism, and stimulate their teamwork abilities.

4.3.4 Compilation of Pedagogical Materials Under the VR Framework

The traditional textbooks of liberal education courses are mainly textual, among which very few are equipped with auxiliary multimedia materials. These textbooks are not compatible with VR-assisted teaching. Therefore, it is necessary to adjust the content of textbooks and pedagogical materials to make them more suitable for VR-assisted teaching, based on the perspective of constructivism theory, the flipped classroom model, and the feasibility of VR technology.

5. CONCLUSION

The present study uses the course named "Overview of Spanish-speaking Countries" — as an example to explore the possibility of applying VR technology to assist teaching in university's liberal education courses. From the perspective of constructivism theory and Flipped classroom mode, the unique characteristics of immersion, interaction, and imagination of VR technology should enrich the teaching in liberal education courses, stimulate students' interest in learning after classes, and magnify students' protagonist position in the learning process, and as a result, improve the students' learning effect. However, as the application of VR technology in liberal education courses is still an emerging concept, more in-depth research and practice are needed in the future.

AUTHORS' CONTRIBUTIONS

This paper is completed by Li Yan and Alex Pak Ki Kwok. Li Yan is responsible for experimental design and manuscript writing, and Alex Pak Ki Kwok has contributed to revising and editing.

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REFERENCES

[1] AAC&U, "What Liberal Education Looks Like". Retrieved from https://portal.criticalimpact.com/user/25043/image/whatlibedlookslike.pdf.

[2] Alaker, M., Wynn, G. R., & Arulampalam, T., "Virtual reality training in laparoscopic surgery: A systematic review & meta-analysis," International Journal of Surgery, vol. 29, pp. 85-94, 2016.

[3] Alhalabi, W. S., "Virtual reality systems enhance students' achievements in engineering education," Behaviour & Information Technology, vol. 11, issue 35, pp. 919-925, 2016.

[4] Axelrod, P., Anisef, P., & Lin, Z., "Against All Odds? The Enduring Value of Liberal Education in Universities, Professions, and the Labour Market," The Canadian Journal of Higher Education, vol. 2, issue 31, pp. 47-77, 2001.

[5] Berg, L.P., Vance, J.M., "Industry use of virtual reality in product design and manufacturing: a survey," Virtual Reality, vol. 21(1), pp. 1-17, 2017.. https://doi.org/10.1007/s10055-016-0293-9

[6] Bhagat, K. K., Liou, W.-K., & Chang, C.-Y., "A cost-effective interactive 3D virtual reality system applied to military live firing training," Virtual Reality, vol. 2(20), pp. 127-140, 2016.

[7] Burdea G, Langrana N, "Virtual force feedback: Lessons, challenges, future applications". In Winter Annual Meeting of the American Society of Mechanical Engineers, Publ by ASME, 1992, pp. 41-47.

[8] Burdea, G. C., & Coiffet, P., Virtual reality technology. Hoboken, United States: John Wiley & Sons, 2003.

[9] Cao Qiaoqiao, "Case Study of Second Life in Education," Computer Knowledge and Technogloy, Vol 25, pp. 7099-7100+7102, 2010.

[10] Jang, S., Vitale, J. M., Jyung, R. W., & Black, J. B., "Direct manipulation is better than passive viewing for learning anatomy in a three-dimensional virtual reality environment," Computers & Education, vol. 106, pp. 150-165, 2017.

[11] Jiang Zukang, Study of The Learning of Second Languages. Beijing: Foreign Language Teaching and Researching Press, 1999.

[12] Khor, W. S., Baker, B., Amin, K., Chan, A., Patel, K., & Wong, J., "Augmented and virtual reality in surgery-the digital surgical environment: applications, limitations and legal pitfalls," Annals of Translational Medicine, vol 23, issue 44, 2016.

[13] Ma Chongyu & Chen Jianlin, "Computer Aided Language Teaching Based on Virtual Reality — Theory, Method and Technology," Digitalized Pedagogy of Foreigh Languages, vol. 06, pp. 28-33，2012.

[14] Ma Chongyu & Chen Jianlin, "A Research of Computer-Assisted Language Learning Based on Virtual Reality — Theories, Methods and Teacniques," Digitalized Pedagogy of China, vol. 2, pp. 121-125, 2013.

[15] Ma Chongyu & Yan Xiaoli, "Research on Distributional Virtual Language Learning Environment Based on DVEs," Journal of Hebei University: Section of Phlosopy and Social Science, vol. 5, pp. 130-134, 2009.

[16] Ministry of Education, "Thirteenth Five-Year Plan for the Development of National Education Development". Retrieved from http://www.edu.cn/html/e/jygh/.

[17] Ministry of Education, Comitte of Development and Reform, National Development and Reform Commission, Ministry of Finance, Ministry of Human Resources and Social Security & Central Institutional Organization Commission, "Education Revitalization Action Plan (2018-2022)". Retrieved from http://www.moe.gov.cn/srcsite/A10/s7034/201803/t20180323_331063.html.

[18] Ministry of Education, "Key Points of Education Informatization and Cybersecurity Work in 2019". Retrieved from http://www.moe.gov.cn/srcsite/A16/s3342/201903/t20190312_373147.html.

[19] Moglia, A., Ferrari, V., Morelli, L., Ferrari, M., Mosca, F., & Cuschieri, A., "A Systematic Review of Virtual Reality Simulators for Robot-assisted Surgery," European Urology, vol. 6. issue 69, pp. 1065-1080, 2016.

[20] Moro, C., Stromberga, Z., Raikos, A., & Stirling, A., "The Effectiveness of Virtual and Augmented Reality in Health Sciences and Medical Anatomy," Anatomical Sciences Education, vol. 6(10) , pp. 549-559, 2017.

[21] Naibiao Jin, Fan Yang, Mian Yan, Yalei Feng, Yusheng Zhuang, Haoyuan Liu, Pak Ki Kwok, Kang Wen, "User Perceptions of Smart Class Services in Teaching and Learning Interactions," Procedia CIRP, Volume 83, Pages 785-788, 2019. ISSN 2212-8271, https://doi.org/10.1016/j.procir.2019.04.329.

[22] Nola, R., & Irzik, G., Philosophy, science, education and culture, vol. 28. Berlin: Springer Science & Business Media, 2006.

[23] Ozdamli, F., & Asiksoy, G., "Flipped Classroom Approach," World Journal on Educational Technology, vol 2(8), pp. 98-105, 2016.

[24] P. K. Kwok, Bill K. P. Chan, and Henry Y. K. Lau., "A Virtual Collaborative Simulation-based Training System," In Proceedings of the 10th International Conference on Computer Modeling and Simulation (ICCMS 2018). Association for Computing Machinery. New York, NY, USA, 2018, pp. 258–264. DOI:https://doi.org/10.1145/3177457.3177494.

[25] Pak Ki Kwok, Mian Yan, Bill K.P. Chan, Henry Y.K. Lau, "Crisis management training using discrete-event simulation and virtual reality techniques," Computers & Industrial Engineering, vol. 135, pp. 711-722, 2019. ISSN 0360-8352, https://doi.org/10.1016/j.cie.2019.06.035.

[26] Pak Ki Kwok, Mian Yan, Ting Qu & Henry Y. K. Lau, "User acceptance of virtual reality technology for practicing digital twin-based crisis management, International," Journal of

Computer Integrated Manufacturing, pp. 1-14, 2020. DOI: 10.1080/0951192X.2020.1803502

[27] Pelargos, P. E., Nagasawa, D. T., Lagman, C., Tenn, S., Demos, J. V., Lee, S. J., Yang, I., "Utilizing virtual and augmented reality for educational and clinical enhancements in neurosurgery," Journal of Clinical Neuroscience, vol. 35, pp. 1-4, 2017.

[28] Qiu Xinyi, "A Model of TCSL Supported by VR Technique," Digitalized Pedagogy of Foreigh Languages, vol 1, pp. 32-36, 2006.

[29] Sams, A., & Bergmann, J. B, "Flip Your Students' Learning," Educational Leadership, vol. 6(10), pp. 16-22, 2013.

[30] State Council, "Guiding Opinions of the State Council on Promoting Actively the Internet Plus Action". Retrieved from http://www.gov.cn/zhengce/content/2015-07/04/content_10002.htm.

[31] Sutherland, I. E., Proceedings of IFIP Congress, Paper presented at the IFIP Congress, 1965.

[32] Wang Cixiao, Li He & Shang Junjie, "Application and Development Prospects of Educational Games Based on Virtual Reality and Augmented Reality," Digitalized Pedagogy of China, vol. 8, pp. 99-107, 2017.

[33] Wang, P., Wu, P., Wang, J., Chi, H.-L., & Wang, X., "A Critical Review of the Use of Virtual Reality in Construction Engineering Education and Training," International Journal of Environmental Research and Public Health, vol. 6, issue 15, 2018.

[34] Wang Zuoliang, "Cultural Comparison in Translation," Chinese Traslator Journal, vol. 01, pp. 2-6, 1984.

[35] Xin, C., "Social changes and the revival of liberal education in China since the 1990s," Asia Pacific Education Review, vol. 1(5), pp. 1-13, 2004.

[36] Yang, Y., Introduction to Virtual Reality Technology Application in Medical Education. In L. Zhang & D. Xu (Eds.), Proceedings of the 2016 6th International Conference on Machinery, Materials, Environment, Biotechnology and Computer, vol. 88, pp. 851-854, 2016.

[37] Zhang Ning, Liu Yingchun, Shen Zhipeng & Guo Chen, "Review of Virtual Reality Technology Based Application Research in English Teaching for Special Purpose," Computer Science, vol. 1, pp. 43-47, 2017.

[38] Zhou Xiaojun, Ma Jun & Xiao Jing, "VRML-based Chinese Remote Education to Foreigh Children as a Second Language," Journal of System Simulation, vol. 1, pp. 167-169, 2006.