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RESEARCH ARTICLE

A Comparative Study on the Effectiveness of Virtual Simulation Technology and Traditional Teaching for New Energy Vehicles Major in China Vocational Collage

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ABSTRACT

This research investigates a comparative Study on the Effectiveness of Virtual Simulation Technology and Traditional Teaching (China's New Automotive Energy Speciality as an Example).The study will major in the case of vocational education in China. With the increasing application of science and technology, the automobile industry is getting more advanced and one dimension gaining more momentum is the emergency of energy vehicles. In the changing environment, the learners need to move with technology and have better ways to conceptualize the use of the technology in real-world applications. That can happen by first getting the simulation (Wu, Lan, & Wang, 2022). That means virtual simulation technology is a key factor in developing energy vehicles and training them to suit the real environment. The research will make and explain a function of simulation technology from a different perspective of teachings like maintenance, controls, and power conversion, among other aspects which make the NEV a success.

1. INTRODUCTION

This paper reports on a study carried out in China investigating the relationship between student's use of Virtual simulation and their learning outcomes in a course on New energy vehicles. The results show a clear relationship between accesses to the VR as measured by questionnaire and outcomes, as measured by final results. While the results do not establish a direct causal connection, they indicate that under appropriate conditions a component of VR study provides significant benefits to learning. In this, it contrasts with the results of recent studies that find no relationship between access and results. Quotes taken from interviews with some of the students illuminate the relationship between VR and their own learning.

At present, there are some problems in automobile education in China. First inadequate educational resources; second, course lagging; third, Students in vocational schools are not learning well. Thus, we need use technology to change the situation.

China uses the term New Energy Vehicles to mean the Electronic vehicles which can be plugged into a charger for charging. The main issue is that that the growing technology of automotive vehicles to be used in education has not fully evolved and they are in beginning stages. That means education systems in China have no sufficient resources which can be used evenly across all learning institutions. That means a single car is applied by many students making the approach incompatible with existing curriculum. The applied NEV technology is might sound like a best move ever but there are some limitation accompanied by the distribution process of the resources. Artificial Intelligent carries much of the technology that must be applied to teach these NEV to move on the roads without accidents (Chen, 2021). Virtual Simulation for teaching NEV is software that uses AI and Virtual Reality innovation to make the new energy vehicle teaching for the students in institutions. It is based on virtual reality capabilities offering forced simulation, artificial intelligent experimentation, and operational training.

In training the NEV, since the installation position of the vehicle and auto parts is not very obvious and must be related to the environment, it becomes complicated to learn the technology about the car. That translates to the point that when training students, it becomes abstract and dangerous to master the structure and relate it to the real environment of operation (Luo, 2021). Due to the complication in mastering the mechanical and electrical structure, a well-simulated technology must come into play to have the students trained in different aspects of operating. Most new energy vehicles are projected to be driver-less and must be fed with all capabilities, which will make them adapt to the roads without needing a physical driver (Zhang, et al 2019). Different things need to be coordinated in the car, like the motor operations, how to make the energy conversion distribution, and power transmission. For student training, virtual simulation was introduced that can manipulate virtual reality structure. Yixing et al. hold different researches on the application of how the virtual simulation software can be used to train new energy vehicles to achieve a constant operation of the vehicles. Yixing et al. also proposed different methods like low-delay, which is based on the network communication for the VR, which can visualize fused real and virtual environment based on the third-party point of view. That means there is much which needs to be done related to the new energy vehicle and training so that the vehicle can fit the real environment from the virtual point of view. That is, through virtual simulation, it is easy to make the virtualization of the real environment.

New energy vehicle is a growing technology which has limited theoretical frameworks and there is little test of the information whether it can make positive implication in the education systems. That means different problems will arise when applying NEV simulation when teaching students, developing the curriculum and making the initial phases of introduction. That signifies there is more needed research on the process of developing the objective of the curriculum and understand the industry in more relatable manner. Use of new energy technology is resource intensive it may make some educational institution which is remotely based delay in access some of the important items like cars to perform the important simulations.

How to use virtual reality to help students improve their observation ability？

1. How to use virtual simulation to improve teaching quality

The study aims to investigate the application of virtual simulation technology in the teaching of new energy vehicle majors at vocational colleges in China.

2. To find out how virtual simulation technology helps students' observation ability？

2. MATERIALS AND METHODS

This research examines the research methods and procedures used to answer the research questions in one of this study. The researcher conducted an experimental procedure in a school of choice in Changchun City, Jilin, China, from where the participants were chosen and surveyed based on the variability of the simulation technology as a method of teaching new energy vehicles. The experiment was carried out based on research Philosophy.

Quantitative research methods were employed in this research, which were chosen based on research aim and objectives and the researcher’s philosophical understanding, experience, and personal beliefs (Bashir et al., 2017).

New Energy Vehicle Professional Exam Questions is designed to synthesise the teaching content of New Energy Vehicle Professional Exam Questions. Post-side test questions were administered to students in the control and experimental groups. The test questions were analyzed for validity and reliability, and the differences between the data were analyzed using T-test.

3. RESULTS

The following table1 showed that the control group (150 college students) obtained the average grade of 83.01 in new emerge vehicle (GNEW) in the pre-test and average grade of 82.93 in the course in the post test. Similarly, they obtained the average grade of 78.05 in car structure (GCS) in the pre-test and average grade of 82.48 in the course in the post test. On the contrast, the experiment group (150 college students) obtained the average grade of 81.28 in new emerge vehicle (GNEW) in the pre-test and average grade of 85.69 in the course in the post test. Similarly, they obtained the average grade of 76.77 in car structure (GCS) in the pre-test and average grade of 84.48 in the course in the

post test. Though the experiment group had the initial grade in either new emerge vehicle or car structure, they had made significant progress after receiving the VR simulation teaching. That is to say, the VR simulation teaching had positive effect on the grade of college students who major new emerge vehicle.

Table 1: Descriptive analysis of students' performance

Groups	Test	Variable	Obs	Mean	Std. Dev.
Control group	Pre-test	GNEW	150	83.01	8.95
	post-test	GNEW	150	82.93	9.28
	Pre-test	GCS	150	78.05	9.19
	post-test	GCS	150	82.48	9.06
Experiment group	Pre-test	GNEW	150	81.28	9.61
	post-test	GNEW	150	85.69	10.60
	Pre-test	GCS	150	76.77	7.01
	post-test	GCS	150	84.48	6.59

Independent samples t-Test table 2 showed that there are no significant difference before the pre-test and post test in term of students'performance in the control group. as its P values of Levene's Test were less than 0.05 (GNew: P=0.530>0.05; GCS: P=0.908>0.05) and the equal variances not assumed were greater than 0.05 (GNW:P=0.939>0.05 GCS:P=0.000<0.05, with error). However, for the experiment group P values of Levene's Test were greater than 0.05 (GNew: P=0.129>0.05; GCS: P=0.539>0.05) and the equal variances assumed were also less than 0.05(GNeW:P=0.000<0.05 GCS:P=0.000<0.05 , that implied there were significant difference between the pre-test and post-test outcomes of experiment group. It further meant that VR simulation teaching have influence on students' performance. In addition, in the independent samples t-Test of pre-test (Control group VS experiment group), the P values of Levene's Test were less than 0.05 (GNew: P=0.114>0.05; GCS: P=0.001<0.05) whilst the equal variances assumed were less than 0.05(GNew: P=0.108>0.05; GCS: P=0.176>0.05) , it implied there were no significant difference between the outcomes of the experiment group and the control group in the pretest in students' performance. In the independent samples t-Test of post-test (Control group VS experiment group), the P values of Levene's Test were less than 0.05 (GNeW:P=0.02<0.05 GCS:P=0.000<0.05 whilst the equal variances assumed were less than 0.05 (GNeW:P=0.02<0.05 GCS:P=0.01<0.05, it also implied there were significant difference between the outcomes of the experiment group and the control group in the posttest in students' performance in grade or NEW or CS. These findings further confirmed that VR simulation teaching have influence on students 'performance.

Table 2

Independent Samples Test of post-test (Control group VS experiment group)

		F	Sig.	t	df	Sig. (2-tailed)
GNEW	Equal variances assumed	5.71	0.02	-2.37	298.00	0.02
	Equal variances not assumed			-2.37	292.89	0.02
GCS	Equal variances assumed	18.35	0.00	-2.48	298.00	0.01
	Equal variances not assumed			-2.48	267.70	0.01

4.

DISCUSSION

Virtual simulation teaching has the following advantages over traditional teaching:

1. **Strong interactivity**: virtual simulation teaching can provide more interactivity, students can participate in the teaching process through simulated experiments, virtual practice and other ways to enhance the learning experience and participation.
2. **Real-time feedback:** virtual simulation teaching can record the learning process and performance of students in real time, give timely feedback and guidance to help students correct their mistakes in a timely manner to improve the learning effect.
3. **Rich resources:** virtual simulation teaching can provide richer resources, including simulation experiments, virtual practice, multimedia materials, etc., to help students better understand and master knowledge.
4. **Flexible:** virtual simulation teaching can be personalised according to the students' learning progress and needs, flexible adjustment of teaching content and methods to meet the learning needs of different students.
5. **High security:** virtual simulation teaching can avoid some experimental operations may exist in the security risks, to protect the personal safety of students.

In conclusion, this study's quantitative and qualitative findings suggest that virtual simulations can improve cognitive comprehension and practical skills in NEV education. Virtual worlds' hands-on learning style seems to fit constructionist notions that emphasize deeper engagement and higher-order memory over memorization. Meanwhile, behaviorist learning approaches like kinesthetic engagement optimized knowledge acquisition of quantifiable outcomes. Through these theoretical views, virtual simulation-based teaching for vocational NEV education showed a slight performance and perception advantage over standard classroom pedagogies.

REFERENCES

Chen, G. (2021, September). The application of 3D virtual simulation technology in automobile maintenance teaching. In 2021 4th International Conference on Information Systems and Computer Aided Education (pp. 104-109).

He, D. (2022). Teaching Practices of a Warehousing Management Curriculum Based on Virtual Reality Simulation Technology. International Journal of Emerging Technologies in Learning, 17(9).

Hao, T., Feng, W., & Su, R. (2022, April). Virtual Simulation Resource Control Platform for Electric Power Training. In Journal of Physics: Conference Series (Vol. 2260, No. 1, p. 012045). IOP Publishing.

Lin, J., & Zhang, Y. (2020, May). Research on the application of virtual simulation technology and vocational education teaching. In Journal of Physics: Conference Series (Vol. 1544, No. 1, p. 012089). IOP Publishing.

Lavrentieva, O., Arkhypov, I., Kuchma, O., & Uchitel, A. (2020). Use of simulators together with virtual and augmented reality in the system of welders' vocational training: past, present, and future.

Luo, H. (2021, February). Development of Pure Electric Vehicle Fault Diagnosis System Based on Virtual Reality Fusion Technology. In Journal of Physics: Conference Series (Vol. 1744, No. 2, p. 022037). IOP Publishing.

Raja, M., & Lakshmi Priya, G. G. (2022). Using virtual reality and augmented reality with ICT tools for enhancing quality in the changing academic environment in COVID-19 pandemic: An empirical study. In Technologies, Artificial Intelligence and the Future of Learning Post-COVID-19 (pp. 467-482). Springer, Cham.

Sun, G., & Wang, X. (2021, May). Application of computer virtual reality technology in practical teaching of construction engineering survey. In Journal of Physics: Conference Series (Vol. 1915, No. 3, p. 032072). IOP Publishing.

Xu, J., & Zheng, Y. (2022, February). The Application of Virtual Simulation Technology and Artificial Intelligence in Network Vocational Course. In 2022 IEEE International Conference on Electrical Engineering, Big Data and Algorithms (EEBDA) (pp. 587-590). IEEE.

Wu, H., Lan, T., & Wang, X. (2022). Development of New Energy Vehicle Teaching System Based on Mixed Reality Technology. In Journal of Physics: Conference Series (Vol. 2185, No. 1, p. 012045). IOP Publishing.

Zhang, X., Ming, X., Liu, Z., Yin, D., & Chen, Z. (2019). A reference system of smart manufacturing talent education (SMTE) in China. The International Journal of Advanced Manufacturing Technology, 100(9), 2701-2714.

Zhan, B., Yu, X., Zhang, J., Luo, P., & Sun, D. (2022). Research and Practice of Virtual Reality Technology in Vocational Education. In International Conference on 5G for Future Wireless Networks (pp. 597-605). Springer, Cham.

Wu Xiaonan, Wang Yijia, Huang Kun, et al. The application and practice of virtual simulation in city gas teaching[J]. Petroleum Education, 2013(5):44-48.

Meng Hu, Li Yuan. The application of virtual reality technology in home design[J]. Journal of Ningde Normal College (Natural Science Edition),2019,31(1):24-30.

Xiao Yanyuan. Research on 3D spatial model based on virtual city [D]. Guiyang: Guizhou University, 2008.

Xu C.W., Liu T.Y., Zhou X. The application of virtual reality technology in interior design and decoration [J]. China Science and Technology Information,2018(1):95-96.

Qin B. The application of virtual reality technology in the interactive analysis of residential interior design [J]. Shanxi architecture,2016,42(25):7-8.

Wang Shun. The application of virtual reality technology in interior design [J]. Green environmental protection building materials,2017(2):37.

Adedoyin, O. B., and Soykan, E. (2020). Covid-19 pandemic and online learning: the challenges and opportunities. Interactive Learning Environments, 1–13.

Amhag, L., Hellström, L., and Stigmar, M. (2019). Teacher Educators' Use of Digital Tools and Needs for Digital Competence in Higher Education. Journal of Digital Learning in Teacher Education, 35(4), 203–220.

Bobka, P., Germann, T., Heyn, J. K., Gerbers, R., Dietrich, F., and Dröder, K. (2016). Simulation Platform to Investigate Safe Operation of Human-Robot Collaboration Systems. Procedia CIRP, 44, 187–192.

Cahyo, T. N. (2016). Software Development of Lighting System Trainer Simulation in Light Vehicle Electrical Maintenance Training Courses Light Vehicle Engineering SMK Negeri 7 Surabaya. Jurnal Pendidikan Teknik Mesin UNESA, 05, 64–71.

Cahyo, T. N., and Wailanduw. (2016). Pengembangan Software Simulasi Trainer Sistem Penerangan pada Mata Diklat Pemeliharaan Kelistrikan Kendaraan Ringan Teknik Kendaraan Ringan Smk Negeri 7 Surabaya. Jurnal Pendidikan Teknik Mesin UNESA, 05, 64–71.

Campos, N., Nogal, M., Caliz, C., and Juan, A. A. (2020). Simulation-based education involving online and on-campus models in different European universities. International Journal of Educational Technology in Higher Education, 17(1), 1-15.

Chae, S. (2016). Development and Application of the Simulator of Lighting Devices for Automotive Technical Education. Journal Of Ptactical Engineerin Education, 8(November), 91–94.

Chang, K. H., and Kuo, P. Y. (2018). An efficient simulation optimization method for the generalized redundancy allocation problem. European Journal of Operational Research, 265(3), 1094–1101.

Coman, C., Ţîru, L. G., Meseşan-Schmitz, L., Stanciu, C., and Bularca, M. C. (2020). Online teaching and learning in higher education during the coronavirus pandemic: Students' perspective. Sustainability (Switzerland), 12(24), 1–22.

Damasceno, E. F., Nardi, P. A., Silva, A. K. A., Junior, J. B. D., and Cardoso, A. (2017). 3D Virtual Simulation approach in Brazilian Vocational Education for Computers Network Adapted to Student Knowledge. IEEE Latin America Transactions, 15(10), 1917–1925.

obricki, M., Evi-Colombo, A., and Cattaneo, A. (2020). Situating vocational learning and teaching using digital technologies - A mapping review of current research literature. International Journal for Research in Vocational Education and Training, 7(3), 344–360.

Elbashti, M., Itamiya, T., Aswehlee, A., Sumita, Y., Ella, B., and Naveau, A. (2020). Augmented Reality for Interactive Visualization of 3D Maxillofacial Prosthetic Data. The International Journal of Prosthodontics, 33(6), 680–683.

Esteve-Mon, F. M., Cela-Ranilla, J. M., and Gisbert-Cervera, M. (2016). ETeach3D. Journal of Educational Computing Research, 54(6), 816–839.

Mayer, B. W., Dale, K. M., Fraccastoro, K. A., and Moss, G. (2011). Improving transfer of learning: relationship to methods of using business simulation. Simulation & Gaming, 42(1), 64-84.

Gegenfurtner, A., Quesada-pallarès, C., and Knogler, M. (2014). Digital simulation-based training: A meta-analysis. 45(6), 1097–1115.

Gönenç, İ. M., and Sezer, N. Y. (2019). Evaluation of the effectiveness of four different training techniques in the development of non-stress testing application skills: A randomised controlled trial. Nurse Education Today, 76(5), 118–124.

Helle, L., Nivala, M., Kronqvist, P., Gegenfurtner, A., Björk, P., and Säljö, R. (2011). Traditional microscopy instruction versus process- oriented virtual microscopy instruction: a naturalistic experiment with control group. 6(Suppl 1), 1–9.

Igwe, N. J.,Kadiri, G. C., and Ekwueme, J. (2020). Impact of Information and Communication Technology on Acquiring the Literacy Skills outside the Classroom among Adults in Nsukka Urban. Journal of Language Teaching and Research, 11(6), 881.

De Jong, T., and Van Joolingen, W. R. (1998). Scientific Discovery Learning with Computer Simulations of Conceptual Domains. Review of Educational Research, 68(2), 179–201.