



Research on the Construction of Virtual Simulation Training Base in Colleges and Universities from the Perspective of Innovative Talent Training

Rong-Quan Zhang¹, Jia-Qing Song¹, Jing Lei²

Office of Educational Administration, Taishan University, Tai'an 271000, China¹

School of Mathematics and Statistics, Taishan University, Tai'an 271000, China²

Abstract—With the development of computer science and the advent of the information age, the experimental teaching in colleges and universities is undergoing profound changes. The construction of virtual simulation training base plays an important role in reforming the traditional teaching methods of college education and promoting the training mode of innovative talents. This paper introduces the virtual simulation technology and its role in the construction of innovative talents, and puts forward some thoughts on the construction of virtual simulation training bases in colleges and universities from four aspects: construction ideas, construction principles, construction models, and construction contents, which provides a valuable reference for the construction of virtual simulation training bases in colleges and universities aimed at cultivating innovative talents.

Index Terms—Higher education, innovative talents, training base, virtual simulation



I. INTRODUCTION

A. Background

With the rapid development of the new generation of information technology represented by artificial intelligence, big data, 5G, virtual reality technology, etc., virtual simulation technology is constantly changing the teaching content, teaching methods, and teaching environment of colleges and universities, breaking through the limitations of traditional teaching models, effectively improving the quality of education, and realizing the personalized and data-driven talent training model. In order to meet the requirements of national strategy and the development of digital economy, serve the training of compound technical talents in the new era and the transformation and upgrading of regional economy, promote the high-quality development of higher education, and build a virtual simulation training base is an important measure for colleges and universities to solve the problems of high investment, high consumption, difficult implementation, and difficult observation in the process of training and teaching. To this end, universities need to continue to explore in the process of building virtual simulation training bases, pay attention to overall planning, strengthen top-level design, and at the same time, expand their vision and highlight their characteristics in combination with their own characteristics.

B. Overview of Virtual Simulation Technology

Virtual simulation technology is to use computers to dynamically simulate the structure, function and process of some systems, and obtain results close to the actual situation. In recent decades, with the development of high-performance computers, electronic component technology, embedded operating systems, and image processing chips, virtual simulation technology is increasingly widely used in various fields, such as simulation training, electronic product design, virtual manufacturing, virtual instruments, VR games, and the concept of the meta universe. The characteristic of virtual simulation is that it can be interacted and repeatedly operated. Therefore, virtual simulation has obvious effects and advantages for strengthening teaching and training and improving drilling effects.

II. THE ROLE OF VIRTUAL SIMULATION TRAINING BASE IN CULTIVATING INNOVATIVE TALENTS

The construction of virtual simulation training base plays the following important roles in cultivating innovative talents:

(1) Deepen practical ability

The demand for talents in modern society requires not only systematic theoretical knowledge, but also practical operation ability. Virtual simulation technology integrates the theory and application of cross disciplines. Using virtual simulation technology can simulate the actual scene, process and content, and deepen the practical application of

theoretical knowledge. Therefore, students' theoretical and practical abilities have been sublimated and improved.

(2) Enhance innovation capability

Virtual simulation technology is expandable. It can design new practice and experiment scenarios through software technology. Through this training, students can expand their innovative thinking, promote innovation and development, enhance their comprehensive quality, and improve their employability and entrepreneurial level.

(3) Improve the utilization efficiency of the training base

Many universities have multiple training bases for different majors, which can only meet the requirements of teaching and training for a single major. With the upgrading of technology and industry, the equipment in the laboratory will gradually age and be eliminated, and the new training base needs more investment. The virtual simulation training base can meet the needs of different majors, and students of different majors can use their virtual simulation laboratories and their software and hardware for online and offline training, thus greatly improving the utilization efficiency of the training base. [7] discussed that according to the observations in this paper, an existing mathematical model of banking capital dynamics should be tweaked. First-order ordinary differential equations with a "predator-pray" structure make up the model, and the indicators are competitive. Numerical realisations of the model are required to account for three distinct sets of initial parameter values. It is demonstrated that a wide range of banking capital dynamics can be produced by altering the starting parameters. One of the three options is selected, and the other two are eliminated. The model is generalized taking into account fractional derivatives of the bank indicators for time, reflecting the rate of their change. Based on numerical calculations, it is established that reduction of the order of derivatives from units leads to a delay of banking capital dynamics. It is shown, that the less the order of derivatives from the unit, the more delay of dynamics of indicators. In all analyzed variants indicators at large times reach their equilibrium values. [8] examined the development and refinement of possible mathematical models for the intellectual system of career guidance. Mathematical modeling of knowledge expression in the career guidance system, Combined method of eliminating uncertainties, Chris-Naylor method in the expert information system of career guidance, Shortliff and Buchanan model in the expert information system of career guidance and Dempster-Schafer in the expert information system of career guidance method has been studied. The algorithms of the above methods have been developed. The set of hypotheses in the expert system is the basic structure of the system that determines the set of possible decisions of the expert system. This set, which is crucial in decision-making, should be sufficiently complete to describe all the possible consequences of situations that arise in the subject area. Therefore, it is important to improve the mathematical models of the intellectual system of career guidance.



III. CONSTRUCTION OF VIRTUAL SIMULATION TRAINING BASE

A. Construction Ideas

The construction of virtual simulation training base is an important part of higher education informatization. Its environment construction is the foundation, resource construction is the key, and service personnel training is the key. The construction should combine the actual needs of talent training in colleges and universities, highlight the professional characteristics, and be based on the professional development of colleges and universities, face the training of innovative talents, connect with regional industries, and help the high-quality development of economy and society. Use new technologies such as virtual simulation to open up new ideas in teaching, seek new mechanisms in specialty, try new models in talent training, and integrate resources of both schools and enterprises to jointly develop the implementation plan of virtual simulation training base.

- **Strengthen the top-level design.** In the early stage of construction, full demonstration should be carried out, not only focusing on the progressiveness of instruments and equipment, but also focusing on whether the instruments and equipment can meet the actual teaching needs. It is necessary to establish a contact mechanism between professional teachers and virtual simulation technicians, encourage professional teachers to put forward opinions and suggestions for the construction of virtual simulation bases, so that virtual simulation experiments can better meet the needs of practical teaching. According to the professional needs and teaching practice, we should build a standard, sufficient and easy to use virtual simulation teaching place, and apply virtual simulation to practice.
- **Highlight professional characteristics.** To build a good virtual simulation training base, colleges and universities should cultivate a high-level school-based virtual simulation training teaching and resource development team, combine different professional characteristics, aim at different application needs, and develop virtual simulation training teaching resources that meet professional needs on the premise of meeting instrument and equipment specifications. We should give full consideration to the actual situation of cross specialty crossing, combine the actual needs of talent training and the development needs of regional industry enterprises, combine the difficulties in our school's practical training teaching, formulate a targeted construction plan and implementation plan, and explore innovative paths and methods that meet the actual needs of the school and the needs of the local industry.
- **Adhere to problem orientation.** Relying on VR/AR/MR and other modern information technologies, and taking the content in urgent need of virtualization in professional practice teaching as the direction, design and build complete experimental teaching projects and supporting resources, so as to ensure the feasibility of virtual simulation teaching

projects, and promote colleges and universities to actively explore a new model of personalized, intelligent, ubiquitous and virtual teaching practice combining online and offline. Designing experimental projects based on students' needs can effectively improve students' professional practice ability and support the cultivation of students' comprehensive ability. Elaborate to create high-quality experimental projects, attach importance to project quality and teaching effects, and make them truly applied to teaching.

B. Construction Principles

- **Focusing on students' training to meet the requirements of comprehensive practical teaching.** It is necessary to meet students' personalized learning needs, with the goal of mobilizing students' enthusiasm and initiative, and paying attention to the improvement of students' ability. The completed base can meet various forms of teaching and training, and enrich teaching content and teaching methods. Realize the upgrading from the traditional training room of single technology to the virtual simulation training platform of comprehensive application of multiple technologies, effectively improve students' comprehensive abilities such as knowledge understanding, problem analysis and hands-on operation, and get rid of the single information teaching method of PPT, so that students can quickly and effectively master professional technology, cultivate information ability, and lay a foundation for the society to cultivate high-quality technical talents.
- **Taking content as the main line, enrich the intermediate link between theory and practice.** We should consider the characteristics of professional training teaching, reasonably determine the teaching content of virtual simulation training, and research and develop virtual simulation training teaching resources. With professional teaching content as the main line, problem oriented, innovative talents training as the goal, adhere to the necessity and applicability. Virtual simulation experiment is used as an auxiliary teaching method to supplement the deficiency of physical experiment, enrich the intermediate link between theory and practice, and reduce the experiment cost. We should actively explore the establishment of a regional co construction and sharing mechanism to realize the open sharing and sustainable application of high-quality virtual simulation training resources. Build an open, extensible, compatible and forward-looking virtual simulation experiment teaching project operation platform, and promote experimental resources to a wider range to improve the use efficiency of resources.
- **Take case teaching as a means to serve the reform of talent training mode.** Innovate various teaching methods to serve the reform of specialty construction mode and talent training mode. Use various methods that can improve the effect of experimental teaching, such as discussion and inquiry, and advocate students' autonomous, cooperative and inquiry learning. The base



adopts new means of virtual simulation training to upgrade from traditional training room with single technology to virtual simulation training platform with comprehensive application of multiple technologies. Reflect the technical characteristics of virtualization, simulation and specialization and the trend of industrial application and development, and strive to reflect progressiveness, forward-looking, practical, operable and exemplary. Form a series of virtual simulation training cases in line with higher education, inject new vitality into professional construction, and open up new growth points for talent cultivation. Enriching the teaching content and improving the quality of teaching connotation through technology updating, so as to drive the transformation and upgrading of professional groups.

- **Take the construction of teachers as the core to promote the digital growth of teachers.** Through the research and development of VR projects, professional teachers and technical experts in the enterprise industry will be united, and the professional skill level of teachers will be rapidly improved by means of corporate temporary employment, project mutual construction and other means. The participating teachers must master the design process of virtual reality training teaching software, and be familiar with the virtual reality technology means and technology routes under the information teaching environment. We should improve the examination, reward and supervision mechanism of experimental teaching team, encourage and support teachers to participate in the construction of virtual simulation training base, improve the informatization application ability and level of the teachers team, so that the teachers team can adapt to the trend of the times, meet the challenges of new technologies, apply what we learn to practical use, improve their own teaching level and innovation ability, and become interdisciplinary talents.
- **Take the evaluation system as the standard to improve the innovative application ability.** Integrate the construction of virtual simulation training base into professional training programs and teaching courses, formulate relevant measures, explore an open and shared teaching performance incentive mechanism, and establish an enterprise project and school training performance replacement and credit conversion mechanism. Pay attention to the combination of virtual and real learning environment, intelligent chemical situation analysis, and information project management to improve students' practical and innovative ability. Through school enterprise cooperation, give play to the advantages of the enterprise, and introduce the real development projects, development tools and development environment of the enterprise. Attract multi-disciplinary and complex talents to form a project team to participate in cooperative development. In practice, enterprise tutors train students in enterprise level development skills, logic, processes and standards.

Cultivate students' practical skills, innovation ability and incubate their entrepreneurial teams.

IV. CONSTRUCTION MODE

- **Innovation ability training support system.** First of all, the teaching content is divided into the smallest teaching unit according to the preliminary preparation, training project selection, mode design, plan formulation, feasibility analysis, team building, project implementation, optimization and adjustment and other aspects. Then, from the two dimensions of teaching unit and innovation ability, taking the teaching unit based on project link decomposition as the horizontal axis, and taking professional knowledge ability, self-cognition ability, social communication ability, team cooperation ability, communication ability, organizational leadership ability, adaptability, emotional debugging ability, time management ability, risk management ability, crisis management ability and other skills as the vertical axis, we will build a precise, refined Precise innovation ability training support system. Then, based on the teaching content of each unit and guided by the ability goal, design appropriate teaching methods, including classroom teaching, classroom discussion, case analysis, data analysis, special lectures, expanded reading, offline experiments, etc. Finally, the virtual simulation experiment is integrated into each link of practical teaching to provide rich scenes and ways to support it, so as to improve the effectiveness of practical teaching in an all-round way.
- **Closed loop improvement strategy of innovation capability.** Around the training objectives of each teaching unit, the evaluation indicators are designed and embodied in the logic, rules and process design of the corresponding virtual simulation experiment module. Through the capture and record of students' key decision-making nodes, we can obtain evaluation data and complete the evaluation of various abilities accordingly. During the experiment, the virtual simulation platform can conduct real-time evaluation of various abilities according to students' current decisions. If the results are lower than a certain threshold, it will issue an early warning to teachers and students. On the one hand, it is conducive to students' dynamic self-adjustment; on the other hand, it will enable teachers to timely grasp students' experience and conduct targeted guidance and error correction. After the students finish the experiment, they can get the scores of the innovation sub ability index and the comprehensive ability index, which can be used as the basis for teachers to evaluate the results, and also provide direction guidance for students' future innovation ability training.
- **Innovative teachers' security needs.** The application of virtual simulation experiment in innovative education enables some teaching units that originally required teachers to teach or organize discussions, experiments and practices to be completed directly or with assistance



through virtual simulation modules, and achieves or even exceeds the teaching effect of traditional methods. This has greatly reduced the demand for teachers in innovative education in colleges and universities, and is conducive to solving the problem of insufficient reserves of teachers in innovative education. At the same time, it also puts forward higher requirements for teachers' comprehensive quality. Teachers need to master innovative theoretical knowledge, management knowledge, relevant professional knowledge and even legal knowledge, have some innovative practical experience, and understand virtual simulation technology. Only in this way can we ensure the teaching quality, make the demand and logic design of the virtual simulation experiment module feasible, and timely deal with the system problems encountered in daily teaching.

V. CONSTRUCTION CONTENT

- **Virtual simulation center.** The virtual simulation service center is mainly used for the overall management of the overall system and the sharing management of data resources. It is responsible for providing a unified platform entrance and platform project display. It is an open platform for students, a management platform for teachers, a monitoring platform for leaders, and a resource display platform. It can realize the unified management of "school-school", the whole platform is maintained by the whole school, and the personalized training bases and supporting corresponding teaching resources of different professional groups are maintained by each professional group.
- **Personalized professional virtual simulation training room.** To build multiple personalized virtual simulation training rooms and related resources based on professional groups, specific teaching projects need to be selected according to the characteristics of professional groups. The teaching project should serve the teaching of professional group courses, support vocational skills competition, qualification certificate examination, promote scientific research innovation, etc. For example, the School of Tourism Management can build a virtual simulation training room for digital tourism and create a digital tourism platform. The financial management professional group can build an intelligent financial and tax virtual simulation training room to build a financial and tax talent base. The economic management professional group can build a virtual simulation training room for economic management services and create a cradle for economic management talents. The IT professional group can build a high-tech virtual simulation training room to build a high-tech highland. The humanities and arts professional group can build a digital art virtual simulation training room, create an art creation center and other highly targeted personalized application scenarios. The Institute of International Education can

build a virtual simulation training room for international exchanges to create an international exchange stage.

- **Virtual simulation training base with sharing function.** The bottom layer should achieve unified interface standards, unified identity authentication, and unified data center, and make full use of cloud+ technology to achieve multi terminal support, multi-screen sharing, full data synchronization, and full process display. It not only breaks through data barriers, promotes multi party data sharing, but also takes demand as the guidance, comprehensively improves data service capabilities, builds campus big data products and service systems based on data science and artificial intelligence technology, and at the same time, improves the coordination mechanism to accelerate the construction of big data ecology.

VI. CONCLUSION

The construction of virtual simulation training base plays an important role in deepening practical ability, enhancing innovation ability and improving the utilization efficiency of training base for the cultivation of innovative talents. Therefore, the construction of the virtual simulation training base must strengthen the top-level design, highlight the professional characteristics, and adhere to the problem orientation. Adhere to student-centered, content oriented, case based, teacher centered, and evaluation based. With the support system of innovation ability training, the closed-loop innovation ability promotion strategy and the demand for innovative teachers as the model, the virtual simulation center, virtual simulation laboratory, virtual simulation training base and other aspects will be built.

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REFERENCES

- [1] Y. Ye, Y. Chen, "Exploration of innovation and entrepreneurship education in engineering management based on virtual simulation," *Journal of Longdong University*, vol. 31, no. 5, pp. 92-95, 2020.
- [2] Y. Dong, "Research on virtual simulation practice teaching of economics and management specialties guided by innovation ability," *Modern Business Industry*, vol. 39, no. 34, pp. 155-156, 2018.
- [3] X. Duan, T. Niu, X. Hou, et al, "Building a college student entrepreneurial team based on the enterprise management simulation platform," *Science and Technology Information*, vol. 16, no. 28, pp. 113-114, 2018.
- [4] H. Li, "Research and practice on the construction of virtual simulation training base in higher vocational colleges," *Electronic Components and Information Technology*, vol. 4, pp. 212-216, 2021.
- [5] P. Liu, L. Huang, H. Zhao, "Application of virtual instrument technology in virtual simulation experiment platform of new engineering," *Computer Education*, vol. 11, pp. 126-129, 2019.
- [6] Z. Yu, "Innovative experimental teaching by using holographic interactive technology," *Science and Education Guide*, vol. 30, pp. 150-152, 2021.
- [7] Christo Ananth, N. Arabov, D. Nasimov, H. Khuzhayorov, T. AnanthKumar, "Modelling of Commercial Banks Capitals



Competition Dynamics”, International Journal of Early Childhood Special Education, Volume 14, Issue 05, 2022, pp. 4124-4132.

- [8] Christo Ananth, A.R. Akhatov, D.R. Mardonov, F.M. Nazarov, T. AnanthKumar, “Possible Models and Algorithms for the Intellectual System of Professional Direction”, International Journal of Early Childhood Special Education, Volume 14, Issue 05, 2022, pp. 4133-4145.

Rong-Quan Zhang received the Master of Education in English major from Shandong Normal University in 2009. He is an experimenter at Taishan University. His research interests include educational administration, teaching management. Email: 492449131@qq.com.

Jia-Qing Song received the Bachelor from Shanghai University of International Business and Economics in 1991. He is an experimenter at Taishan University. His research interests include educational administration, teaching management. Email: jiaqing_song@126.com.

Jing Lei (corresponding author) received the B.S., M.S., and Ph.D. degrees from Ocean University of China, in 2003, 2007, and 2010, respectively. She is a professor at Taishan University. Her research interests include educational administration, teaching management. Email: elizabethia@126.com.