Journal of Education and Educational Research
ISSN: 2957-9465 | Vol. 2, No. 1, 2023

Experimental teaching reform of Safety engineering specialty enabled by virtual simulation

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Abstract: Innovation is the core driving force of undergraduate teaching reform, especially for local application-oriented undergraduate, especially for safety engineering major. However, due to the complex experimental conditions, some experiments involve extreme environment, high cost, high consumption and possible accident risk, so in real experimental environment, the implementation of these experiments may be limited to some extent. According to the education concept of integration of knowledge and practice, we are committed to building a virtual simulation teaching space and innovating the application of simulation experimental teaching resources, so as to promote the development and improvement of experimental teaching of safety engineering major.

Keywords: Safety engineering; Teaching reform; Virtual simulation.

1. Necessity of experimental teaching reform of safety engineering specialty

Therefore, it has become an urgent task to establish a reliable safety engineering experiment teaching mode and cultivate safety engineering professionals with superb skills.

The development of safety engineering is faced with many challenges, among which the most prominent ones are: first, there are many experimental projects, and there are security risks; Second, the number of experimental classes is limited, unable to meet the needs of students for safety knowledge; Third, the test content is diverse, involving major machinery and equipment, boiler pressure vessels, inflammable and explosive chemicals, if there is a mistake in the process of the experiment, may lead to serious safety accidents; Fourth, the practical teaching effect is not good, students lack practical ability, unable to reach the ideal level of safe teaching. With the large reduction of experimental hours, some experimental projects cannot even be opened normally; In addition, there is less investment in scientific experiments, limited room and hardware for teaching experiments, few sets of teaching experiment equipment, outdated teaching experiment equipment, and the requirements of the experiment project itself, it is difficult to repeat several times, so that the experimental effect is not satisfactory. In addition, the experiment content is abstract, and the real experiment is difficult to reach the predetermined goal, such as safety evaluation and accident investigation courses, and relevant teaching experiments cannot be carried out at the accident site, which are all important factors affecting the quality of experimental teaching [1].

In view of the development trend of safety engineering science experiments, the original experimental mode has been unable to meet the needs of today's society for the training of applied talents, so virtual simulation experiment teaching arises at the historic moment, IT is a perfect combination of disciplines and IT new mode, can use advanced unreal reality, computer interaction, multimedia technology, database system and computer network communication And other IT, to create a more realistic unreal experimental situation and test objectives, so as to better adapt to the needs of security engineering professional personnel training. Through the use of virtual experiment equipment, students can carry out experimental teaching content in the virtual reality situation, so as to achieve the predetermined goals. At the same time, the network platform is used to guide students to carry out innovation, research complex and changeable safety engineering problems, and cultivate application-oriented professional talents who can adapt to the needs of the information age.

2. The goal of experimental teaching reform of safety engineering major

Safety engineers who adopt the "big safety education" talent training method [2] aim to train students to have professional knowledge of information security in various industries, so as to meet the needs of economic development in Luliang area. Therefore, we have established a virtual simulation experiment stage of four modules of coal mine safety, building safety, mechanical safety and chemical safety, in order to support the professional practice of safety engineering Curriculum, knowledge learning, product practice, graduation project (thesis) and other teaching links, to achieve specific construction goals.

2.1. Strengthen the connection between experimental course groups to make the knowledge acquired by students systematic and consistent

Through the construction of the gradual continuation relationship and correlation strength among the core curriculum groups of safety engineering, the cohesion and transition between courses are improved, so as to solve the fragmentation of students' learning process, improve the autonomy and consistency of knowledge learning process, and strengthen the breadth and depth of students' understanding of safety engineering professional knowledge. The organic combination of simulation software and hardware is used to create a realistic environment for students, so that they can experience real emotions in the virtual world,

and improve their professional quality and ability.

2.2. Encourage students to carry out active and innovative exploration by promoting industry-university-research cooperation, so as to improve the learning effect

By using simulation software such as multi-industry workplace hidden danger detection system, students can gain more knowledge and skills in experimental practice teaching, which can not only broaden their horizons, but also stimulate their interest in independent R&D innovation. The application of virtual reality technology can make students get rid of the restrictions of the real environment, break the restrictions of time and space, and broaden the boundaries of experimental practice infinitely. Even the most dangerous experimental environment can be immediately present, so that students can improve their own literacy in the process of scene simulation, so as to better grasp the experimental skills, better realize their own value, and better serve the society. Through continuous training of cooperation, communication skills and sense of responsibility, I will eventually become a modern professional talent who can meet the needs of enterprises.

2.3. Build the experimental teaching model of learning-exercise-exam-evaluation

Through the use of virtual simulation software, it can effectively alleviate the safety engineering research field experiment risk, high test and maintenance costs, the practice of students difficult to do, reflect the teaching concept of "workshop into the campus", improve the degree of integration of teaching and practice, to achieve the effect that classroom teaching cannot achieve, at the same time, give full play to the function of virtual simulation software, experiment content set, Process record and construct a complete experimental teaching model of learning, practice, examination and evaluation [3].

3. Implementation process of experimental teaching reform of safety engineering major

Experiment is an important part of the training of undergraduate students majoring in safety engineering. It can not only effectively combine theory with practice, but also solve the main problems existing in the experiment. Therefore, we set up a complete system of virtual simulation experiment teaching platform to help students better learn all kinds of professional theoretical knowledge. By using this network platform, we can guide students to carry out various innovative activities, analyze complex safety engineering problems, and cultivate professionals who can meet the needs of the information age [4].

3.1. Close combination with the existing traditional laboratory, fully integrate experimental teaching resources

The experimental teaching centers of local colleges and universities should adhere to the principle of "fusion of virtuality and reality, mutual promotion, and not virtuality", organically integrate experimental teaching and scientific research work, so that students can deeply experience the operation process of experimental projects in the virtual environment, so as to better grasp the experimental technology and improve students' ability. By integrating the development strength and services of enterprises and neighboring schools, a complete digital teaching experiment course resource system is established, including equipment resource sharing, software system resource sharing and remote-control virtual teaching experiment, so as to promote students' autonomous learning, inquiry learning and coordinated teaching under the condition of Internet information, further improve teachers' teaching ability and enrich the content. Widen the practical application field, greatly reduce the cost of teaching experiment production and management risk, to achieve green experiment.

3.2. Strengthen virtual simulation teaching and enhance the consistency of experiment system

The engineering discipline aims to cultivate senior engineering and management talents with the ability of information security application research, technology innovation, design, risk assessment, supervision and management, detection and monitoring, organization, education and training, and emergency rescue, so as to meet the needs of today's economic and technological development. Due to the strengthening of virtual simulation teaching, the course practice of safety evaluation, accident investigation, information security man-machine and so on is organically combined to form a complete system, so that the practical work is more convenient and the results are more intuitive and clearer. At the same time, the combination of virtual technology and other scientific and technological equipment is used to create a virtual event experience scene, so that students can change from a third party to experience, and truly feel the event the whole process, so as to more clearly understand the importance of safety related concepts, as well as the complete operation process. By making the original boring theory lively and interesting, it not only makes the practice lively and interesting, but also integrates the practice of multiple courses together, so that students can fully understand and master the knowledge.

3.3. Give full play to the advantages of virtual simulation experiment teaching, stimulate learning motivation and teach students according to their aptitude

The three features of virtual reality technology: innovation, immersion and interactivity, break through the traditional time limit, create more opportunities for users, colorful content and innovative forms, mobilize the enthusiasm of users to learn, make teaching more fun and effective. Learning motivation can be divided into external factors and internal factors, and internal factors can improve learning results." The learning behavior of passive acceptance emphasizes "active exploration ", while virtual reality technology can transform knowledge points from two-dimensional to three-dimensional, making the teaching process more three-dimensional and arousing users' interest. With the use of virtual reality technology, we can completely change their concept of learning, allowing them to explore and embrace knowledge as explorers. This new teaching tool enables them to experience the fun of independent innovation in practice and radiate more creativity.

Through virtual reality technology, we can produce and dynamically transform the contents of biology, physics,

biochemistry, technology processing, aircraft driving cars, programming language, social development history, human science geography, history, culture and traditional folk customs and other disciplines, providing a self-learning environment for students, transforming from the traditional learning mode of "promoting learning by teaching" to the new one for students to use Information environment and tools to acquire knowledge and skills of the new way of learning, which not only conforms to the new round of teaching reform of the educational concept, but also provides students with more learning opportunities, so that they can better grasp the knowledge, better give full play to their potential, and thus realize the maximum value of their life. In this way, we can help students develop core qualities.

3.4. Take advantage of collaborative education to realize the reform of safety engineering experiment teaching mode

The implementation plan of experimental teaching is the key link to determine the success or failure of the reform and has great significance to the implementation of the reform. In order to achieve the goal of professional training, the following points are proposed for the experimental teaching of the core curriculum of safety engineering major:

3.4.1. Clarify learning objectives and achievements

Through virtual simulation technology, students can have a deeper understanding of safety engineering related issues, master the analysis methods, judgment, evaluation, prevention and control methods of safety and traffic accidents, and be able to use information system description, construction mode, analysis methods to solve problems and discuss skills, as well as the skills of dealing with complex engineering problems. For example, automatic moving camera in 3D environment can be used to display safe production process, safety and environmental accident site in combination with pipeline operation and dubbing explanation, so as to better help students understand the knowledge of safety engineering and improve their safety awareness. Through visual activity display, operators can more intuitively understand the changing trend of process materials, important machinery and equipment, risk sources, etc., so as to better grasp the types of risk sources, the occurrence and development process of events and accident disposal measures [5]. In addition, 3D simulation technology is applied to carry out virtual reality simulation of safety product perception, operation safety, process safety and event situation restoration according to the development and evolution process of event occurrence -- event prevention -- occurrence -- accident. Several modules such as overall product perception, process perception, mechanical equipment perception and risk source perception of enterprise are integrated to form 3D simulation software High level of safety management, improve safety work efficiency, reduce the possibility of accidents. Students can experience the "immersive" reality of the virtual reality system, which transcends the real world and allows them to interact with it in real time, allowing them to have more fun and surprise in the virtual world.

3.4.2. Build a distinctive experimental curriculum system for training innovative talents

In order to meet the needs of regional economic development, we have established a complete curriculum system aimed at cultivating students' professional ability and practical skills in safety. This curriculum system includes: general education course, safety engineering professional theory course, comprehensive practice and innovation and entrepreneurship course, which aims to help students better grasp the basic knowledge of new engineering, and be able to solve practical problems.

In order to ensure that the knowledge acquired by students is systematic and coherent, the courses of safety management, safety evaluation, safety man-machine, accident investigation and safety system engineering are adjusted as follows: safety management -- safety systems engineering -- safety evaluation -- safety man-machine -- accident investigation. Form a set of comprehensive and integral experimental teaching chain, so that the core curriculum between the connection and cohesion more closely.

3.4.3. Clarify teaching strategies

Through the platform of school-enterprise cooperation, we are able to enable students to draw expertise from textbooks and apply it to practical projects. We will teach according to real events, which will help them better understand and grasp the knowledge point. At the same time, we will also use VR/AR virtual accident simulation classroom to help them find and analyze difficult problems, so as to cultivate their project innovation and practical ability.

3.4.4. Scientific assessment mechanism

The examination mechanism is an important means to evaluate the actual ability of students. The traditional experiment report cannot really reflect the actual skills of students. In order to cultivate innovative technical personnel, it is necessary to strengthen the assessment of practical skills, focusing on students' practical ability, ability to discover and solve problems and ability to answer random questions. In addition, combining with the opinions of both school and enterprise mentors, a scientific assessment mechanism should be established to stimulate students' strong interest in practical operation and practical initiative, so as to better cultivate innovative skills Training of technical personnel. By cultivating students' ability to discover, analyze and solve problems, we aim to cultivate them into creative technical talents.

4. Conclusion

Through the research and development and application of virtual simulation experiment teaching project, the balance of experimental cost, risk control and teaching demand is achieved. With the help of virtual simulation software, the experimental teaching model combining virtual and real is realized, and the virtual simulation experiment full of imagination, immersion and interaction is integrated into the teaching process to provide students with a variety of sensory stimulation and wonderful interaction. Enhance teaching effectiveness by creating immersive learning experiences. With the help of simulation software such as multi-industry workplace hidden danger screening system and based on the development and evolution process of accident hidden danger -- accident prevention -- accident occurrence -- accident, the virtual simulation of safety cognition, operation safety, process safety and accident environment restoration is implemented, and the reform and practice of the integrated teaching model of classroom-simulation-factory is promoted to form a unique new model of engineering application-oriented talent training. Virtual simulation teaching can realize the virtual center construction mode of multiple

collaboration of the college, introduce high-quality enterprise resources to participate in the construction of the center, and use guiding investment to attract major virtual simulation enterprises and business units of related industry disciplines to invest in the construction of virtual simulation teaching resources. To construct experimental teaching co-construction, sharing, teaching service and technical support based on open virtual simulation experimental teaching platform, so as to meet the requirements of large-scale opening of virtual simulation experimental teaching resources, and realize the sharing of campus, interschool and society.

Acknowledgments

The project of teaching reform and innovation in Shanxi universities in 2022:

“Construction and practice of ideological and political education of safety engineering courses under the promotion of undergraduate tutorial system” ((No.: J20221150);

The project of teaching reform and innovation in Shanxi universities in 2022: “Research on the construction of virtual simulation experimental teaching platform system for mining engineering specialty under epidemic prevention and control” ((No. J20221158);

The project of the Ministry of Education “The experimental teaching reform of safety engineering enabled by virtual simulation” (No. 220501867104653).

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