Application of Virtual Simulation Technology in Theory and Experiment Teaching of Air Pollution Control Engineering

Xiao-Ju Wen*, Lin Hu, Zong-Tang Liu, Zheng-Hao Fei, Wei-Hua Tao
School of Chemistry and Environmental Engineering, Yancheng Teachers University, Jangsu 224007, China
* E-mail of the corresponding author: wenxiaoju1990@126.com

Abstract
Virtual reality technology provides great convenience for humans to explore the macro and micro worlds due to its extremely realistic experience, and it will be seen in all walks of life in the future. This paper focuses on the analysis of the current situation of virtual simulation technology in the teaching application of air pollution control engineering theory teaching and experimental teaching, as well as the advantages and disadvantages of application. Furthermore, the development and prospect of virtual simulation technology in air pollution control engineering theory and experimental teaching are summarized.
Keywords: virtual simulation technology, air pollution control engineering, theoretical teaching, experimental teaching

1. Application of virtual simulation technology in teaching

Virtual simulation technology, also known as computer simulation technology, uses a computer to generate a three-dimensional dynamic real scene, and simulates the structure, function and behavior of the system as well as the thinking process and behavior of the people involved in the control of the system in a dynamic and realistic manner [1]. Virtual simulation technology is mainly used in professional fields with high practical operation requirements, such as military training, engineering design, safety exercises, medical treatment and other related industries. Compared with the traditional forms of text, pictures, and videos, virtual simulation allows users to interact to enhance the training effect of teaching and drills, and solve the "three highs and four difficulties" (high risk, high cost, high pollution, difficult to observe, difficult to move, difficult to enter, difficult to reproduce) problems. Virtual simulation technology can achieve the expected teaching effect and teaching quality, solve the problem of insufficient teaching resources and training bases via creating a virtual teaching system when teaching resources, venues and teaching teachers are insufficient, including teaching venues, training bases, virtual teachers, etc[2]. In addition, this technology can help each student get practical training and improve professional skills by imitating the real enterprise work environment and related specific operations. For some complex subjects that are difficult to demonstrate all the main points in the classroom, the "virtual simulation" technology is used to restore the real scene, or some unexpected situations that may be faced, so that students can master it more comprehensively. In recent years, with the support of relevant national policies, my country's virtual training platform has developed explosively. The virtual simulation experiment training teaching can improve the willingness of the educated to learn behavior by providing highly simulated and visualized teaching content, and creating a practical training teaching situation with a sense of presence, immersion and interactivity, thereby improving the learning effect.

2. The main problems of traditional air pollution control engineering theoretical teaching and experimental teaching

The traditional classroom teaching method focuses on theoretical teaching. Teachers often use PPT, video, oral, blackboard writing and other methods to impart knowledge to students, which makes students receive a certain gap between knowledge and practice. But in fact, knowledge itself is vivid and rich in actual content, while its expressive language, symbols, diagrams, etc. are abstract and simple. The textbooks that students learn in class are only book knowledge that is composed of Chinese characters and grammar, which requires students to understand the actual content they represent through language, symbols, and charts no matter what knowledge they learn [3], That is, comprehension learning, which is difficult for students with poor understanding level. Secondly, the traditional classroom teaching method emphasizes rational cognition and neglects perceptual cognition. In traditional classroom teaching, perceptual knowledge is considered to be specific materials that can only provide knowledge, and only rational knowledge can grasp the essence of things. This concept of emphasizing rationality and ignoring sensibility will affect the pursuit of theoreticalization and abstraction in teaching, and is not conducive to students' mastery of knowledge [4]. However, the discipline of air pollution control engineering needs students to be able to understand rationally and master concepts, formulas and principles, learn to think independently and explore the mechanism. Educational psychology research shows that the process of students mastering knowledge is a combination of perceptual cognition and rational cognition. If

students have rich perceptual knowledge, clear appearance, vivid imagination, it is easier to form rational knowledge and understand book knowledge. On the contrary, it is difficult to master the concepts, formulas and principles in books [5], which is undoubtedly a defect of traditional theoretical teaching methods.

3. The application of virtual simulation technology in the teaching of air pollution control engineering course

3.1 The application of virtual simulation technology in the theoretical teaching of air pollution control engineering

As an environmental professional core course, air pollution control engineering is a systematic introduction to air pollution in view of the characteristics of my country's urban air pollution from soot-type pollution to motor vehicle and soot composite pollution, combined with the latest progress in air pollution control technology and atmospheric scientific research at home and abroad [6]. In the theoretical teaching of air pollution control engineering, it is necessary to involve many difficult teaching contents that cannot be practically operated in the classroom, such as the operation status of desulfurization and denitrification equipment in power plants, the electric bag dust removal process for dust removal, and its affiliated limestone grinding and pulping, slurry supply system, flue gas pressurization and diversion system, liquid ammonia storage supply system, ash conveying system, etc. Through virtual simulation technology, these contents can be vividly displayed to students in the classroom, allowing students to get close to the details, understand the principles and operation process more intuitively, and improve the quality of teaching [7].

3.2 Application of virtual simulation technology in experimental teaching of air pollution control engineering

In the training of environmental engineering students, the experimental teaching of air pollution control engineering occupies an important position. Due to the limited teaching conditions, the traditional experiment course of air pollution control engineering cannot offer many experiments often encountered in practical problems, which greatly limits the cultivation of students' ability to deal with practical problems. For example, some experiments involve toxic and harmful or flammable and explosive substances, and the existing laboratory conditions are not available, and relevant experiments cannot be carried out; Some instruments and equipment are too expensive to buy and cannot carry out corresponding experiments; Restricted by objective conditions, it is impossible for students to control the chemical production process and thus affect the practical effect [8]. In recent years, with the development of modern industry, the technology of environmental protection industry is becoming more and more complex. It is difficult for students to understand the working principle and structure of all environmental protection equipment in traditional experimental teaching. Moreover, modern atmospheric enterprises have a high degree of automation and high requirements for on-site operation. The vast majority of positions must be on duty with certificates. Due to the consideration of factory production and students' personal safety, enterprises further restrict the time and space scope of students' practice on the production site, so that the factory practice only stays at the level of visiting, and cannot go into the production site, resulting in the deviation between practice and theory [9]. Virtual simulation experiment teaching can effectively solve the process that can not be realized or difficult in traditional teaching, make up for the shortage of traditional experimental teaching, improve experimental teaching efficiency and students' innovation ability.

In the experimental teaching of air pollution control engineering, virtual simulation technology can simulate the wet desulfurization process of 1000 MW coal-fired units. The whole process includes desulfurization absorption tower system, gypsum dehydration system, limestone slurry preparation system, limestone slurry storage system, gypsum discharge system, and defogging system, etc., each system is linked with each other [10]. This is a level that traditional experimental teaching is far from reaching. It truly shows the desulfurization process in coal-fired units, allowing students to perfectly combine theoretical knowledge in books with real scenarios, understand and master the key knowledge points such as the complete operation process, experimental principles, factors affecting desulfurization efficiency, and break the barrier between practice and theory. In addition, virtual simulation technology is also used in typical flue gas desulfurization and denitrification 3D simulation factory systems and volatile organic pollutants (VOCs) systems, which will be popularized in experimental teaching in the near future. These technologies include three levels of experimental operation, engineering design, and process construction, making the education system more multi-dimensional and interactive.

At present, the air pollution control has developed many virtual simulation module, mainly contains millions of desulfurization of coal burning power system virtual simulation software, atmospheric diffusion parameter estimation model and the application of virtual simulation software, form more complex flue gas pollution innovation virtual simulation software, the flue gas purification process to build virtual simulation software, flue gas emissions online detection of virtual simulation software [11]. These virtual software can greatly improve the experimental teaching effect of air pollution control engineering and improve students' deeper understanding of air pollution control courses.

4 Development prospects of virtual simulation technology in the application of air pollution control engineering theory and experimental teaching

At present, comprehensive natural environment modeling and simulation technology has become a public support technology and key core technology in the field of advanced distributed simulation all over the world, which undoubtedly provides help for the development of information-based virtual simulation in the teaching of air pollution control engineering. It will drive the development of knowledge dissemination in the field of environment inside and outside the classroom. Nowadays, the modeling and simulation technology of air pollution control engineering is developing in the direction of multi-disciplinary integration, real-time dynamic and distributed coordination. The further research and focus of atmospheric environment modeling and simulation include: extraction technology of atmospheric environment feature, atmospheric environment multi-resolution modeling and dynamic simulation technology, multi-source atmospheric environment data fusion technology, atmospheric environment polymorphic data representation, atmospheric environment simulation real-time database technology and atmospheric environment modeling and simulation standard specifications. These technologies will be closely displayed to students in the theoretical teaching of air pollution control engineering in the future. Since then, the classroom is not only about text narration and data presentation, but also about using virtual simulation technology to draw students into real scenes to experience the charm of teaching in the new era.

5 Conclusion

This paper discusses the convenience and existing problems brought by virtual simulation technology in the theoretical and experimental teaching of air pollution control engineering, and discusses the significance of its application and the future development trend. Although virtual simulation technology is not widely used in air pollution control engineering teaching today and there is still some technical and financial deficiencies. However, with the development of information technology and the transformation of traditional teaching, Virtual simulation technology will have immeasurable development potential in the field of air pollution control engineering teaching. At the same time, since the virtual simulation experiment may not be able to fully estimate various unexpected situations that may occur in the real experiment process during the design process, the virtual simulation experiment cannot completely replace the real experiment. As long as the virtual simulation technology is combined with the real experiment, and the essence and the dross are taken, it will make a greater contribution to the country's cultivation of outstanding environmental engineering talents.

Acknowledgments

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