

Application Research of Virtual Simulation System From Complexity Perspective

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Abstract: The “Intelligent Manufacturing Technology and its Application” in higher vocational colleges has some problems such as limited practical training resources, high maintenance costs and security risks in the running process. Even if there is a simulation, it is a simple simulation. The repetitive imitation of traditional practical training links, and the virtual simulation teaching does not fully reflect the characteristics of virtuality, interactivity and spatiotemporality. Because of the existing problems in the training simulation development and application of the current curriculum, the development and application of the virtual simulation system under the complexity perspective is proposed. The results show that this application can improve the effectiveness of virtual system applications.

Keywords: Complexity; Virtual simulation; Vocational education

Online publication: July 12, 2024

1. The problems of traditional virtual simulation

1.1. The development concept is not advanced

In the process of virtual simulation teaching, the practical projects, objectives and rules are all depending on the teacher. This teaching mode pursues short-term and direct aims and can achieve immediate results. Its biggest features are practicality and utility. As a teacher-oriented teaching mode, it emphasizes the important role of teachers and believes that teachers should play the role of standardizing and guiding students ^[1]. At the same time, due to the concept of industrialization, standardization and specialization, this teaching mode will also be impacted and affected to different degrees. Because the pursuit of standardization and uniformity is too much, attention is not paid to the individual differences of students. Thus, different students’ skill learning needs and pursuit of all-round development cannot be fully satisfied. The spiritual needs of students have not been paid attention to, which contradicts the educational concept of teaching students according to their aptitude, fostering universal talent ^[2].

1.2. The operation mode is not novel

Part of the virtual simulation system is just a simple imitation of practical training equipment, without

integrating into the new formats, new technologies and new standards of industrial transformation. In addition, it also does not study the learning characteristics and personality characteristics of higher vocational students in the new era, thus it cannot keep up with the development trend and social progress. In essence, it is a change in form based on practical training. No new elements are added, so the unique charm of virtual practical training cannot be fully displayed. Students are also forced to participate in the virtual simulation with a reluctant attitude, and there is no spiritual collision and communication, resulting in a less active teaching environment in the classroom^[3,4].

1.3. The practice is not integrated

At the present stage, the virtual simulation teaching mode is not coherent, nor has it been consistently implemented for a long time, so each practice subject cannot carry out adequate communication and transportation. When conducting virtual simulation training, this teaching mode completely overcomes the constraints of space and time faced by traditional practical training, and it can simulate without time and space restrictions. At the same time, some projects that cannot be completed in the practical training process can be completed by virtual simulation, which can further expand students' learning space^[5,6]. However, the traditional teaching process only completes the basic operations in the existing classroom and the training room, which does not fully reflect the characteristics of virtual openness. At the same time, the entire virtual simulation is only a supplement to the actual training equipment, showing a fragmented state, there is no systematic design for a certain course and the linkage between the students and the practical training is not consistent. Students cannot experience the improvement of skills brought by the course through the virtual simulation. In addition, in the training process, there is no interactive operation, resulting in students' operation being just a simple imitation, unable to carry out quantitative assessment and personalized analysis, resulting in virtual simulation losing its charm of the game similar to the upgrade^[7-9].

2. Development of virtual simulation system from the complexity perspective

2.1. Open design

The closed and isolated teaching mode will eventually be eliminated from the stage of history. It is necessary to introduce various emerging theories and technologies in real-time, reasonably introduce them into the virtual simulation teaching system, fully explore the value of these technologies, and hold an open mind towards new things. First, practical methods. For those applications that cannot be directly applied by virtual teaching, traditional practical teaching always holds a one-size-fits-all attitude. However, if we can change our thinking and skillfully apply these applications to virtual simulation, we can achieve surprising results. Second, is the improvement of the teacher-student relationship. In the virtual simulation teaching process, teachers no longer occupy the dominant position, but more towards the identity of director, coach and instructor, based on the principles of democracy, equality and cooperation to provide necessary help for college students. This way, they can establish critical thinking skills, learn how to correctly analyze and look at problems and cultivate their ability to solve problems. Third, practice the concept. We should completely abandon the wrong idea of the "intellectual education concept" and transform professional knowledge into personal ability^[8]. Various types of intelligent devices can provide powerful help to students' memory, knowledge storage, data calculation, communication, etc. With the help of these devices, students can set aside more time and energy for thinking and creation^[5].

2.2. Overall layout

It is necessary to have a comprehensive and objective cognition of virtual simulation teaching based on the whole perspective. Although practical teaching has many problems such as lack of funds, lesser projects, limited coverage and so on, its great teaching value is still undeniable, which cannot be replaced by virtual simulation teaching. To avoid the wrong idea of “merely interesting” and “merely attractive”, virtual simulation teaching should be rationally planned from the following aspects:

- (1) First, keep up with the trend of theoretical development.
- (2) Second, strengthen the cooperation.
- (3) Third, build a distributed and networked sharing mechanism, through which the communication between teachers-teachers, teachers-students, and students-students will be closer, so that the value and role of virtual simulation teaching results will be brought into full play.
- (4) Fourth, invest more funds.
- (5) Fifth, fully mobilize the enthusiasm of teachers and students.

2.3. Dynamic monitoring

The virtual practice teaching system is not fixed, but is constantly in a state of ups and downs, which requires educators to make reasonable adjustments according to the situation, to ensure that it always maintains a dynamic balance. First, we should keep up with the development trend. In the era of knowledge and information explosion, educators should keep pace with trends, pay close attention to trend changes, integrate the characteristics of development trends into practical means and specific practical content, besides appropriately adjust relevant concepts, data and information. Second, it should fit in with the actual needs of students. While developing corresponding practical projects for each major, we should also pay attention to the different needs of different students, provide them with more choices through targeted design, respect each person’s choice, effectively stimulate the individual’s subjective initiative, so that they can actively participate in the learning practice, rather than cope with the problem and be forced to participate in the practice. Third, the existing feedback mechanism should be improved and perfected. We can make full use of questionnaires, student discussion and other ways to have a deep understanding of students’ views, continue to adjust the direction, innovate in the way of thinking, and properly solve the problem ^[10].

3. Application of virtual simulation system in the complexity perspective

3.1. Student-oriented course design

The introduction of virtual simulation technology into the teaching of “Intelligent Manufacturing Technology and its Application” of manufacturing technology and equipment major in higher vocational colleges can only fully integrate theoretical knowledge into practical skills through the virtual environment, offering help to students, so that their comprehensive quality can be comprehensively improved ^[11]. The whole teaching process is subdivided into three stages:

- (1) Before class: Introduction of tasks. Teachers assign intelligent manufacturing application tasks through the cloud platform, guide the learning process, analyze the learning situation and adjust teaching strategies. Students are exposed to new “knowledge” by learning online resources, completing surveys and conducting pre-class tests.
- (2) During the class:
 - (a) To learn new knowledge. The teacher analyzes the task requirements of intelligent manufacturing of complex parts and uses the task as guidance to penetrate the new knowledge. Students make clear

the task requirements, use various resources, learn new knowledge, master the internal mechanism, and realize “knowing” new knowledge.

- (b) Research methods. Teachers start from the actual workflow to inspire intelligent manufacturing line assembly and control ideas. The students actively explore the work plan, carry out the discussion of the assembly and adjustment joint control method and realize the “research” method.
- (c) Imitation steps. Teachers guide students to use virtual simulation software to verify the implementation steps of intelligent manufacturing tasks. Students use the virtual simulation platform to determine the implementation steps, clarify the responsibilities of members, demonstrate the rationality of the steps, and realize the “imitation” steps.

(3) After class:

- (a) Training skills. According to the intelligent manufacturing production task process, teachers demonstrate the operation and emphasize the key steps. Students cooperate as small groups, through group PK, teachers-students PK, to complete the installation, joint control and manufacturing tasks, to achieve “training” skills.
- (b) Competition skills. Teachers organize students to carry out inspections and put forward suggestions for task optimization according to the scoring standards of intelligent manufacturing competition. Students will match the competition standards, match the result of the task through self-check, mutual check and teacher check, complete the task optimization, and achieve the “competition” ability.
- (c) Results evaluation. According to the completion of students’ tasks, teachers implement class summary and summary of the completion of the task. Student evaluation standards are based on self-evaluation, mutual evaluation, teacher evaluation and enterprise mentor evaluation to implement multiple assessments, to achieve the “evaluation” results.
- (d) Extension technology. Teachers rely on the competition simulation system to expand the productive practical training tasks of intelligent manufacturing. Through simulation, students consolidate their skills, participate in productive practical training tasks, expand new technologies, new standards and new norms of intelligent manufacturing, realize knowledge transfer, and achieve “wisdom”^[12].

3.2. Integrated resource design

Integrated teaching design is divided into two parts: online and offline. Design of online teaching resource uses intelligent vocational education professional teaching resource library to carry out virtual simulation online teaching. The resources include PPT, simulation video and animation, exercises after class and other learning resources. At the same time, the platform can also foster the linkage with the college library and professional library, where teachers can view students’ online learning progress in real-time, and serve as the main assessment point^[1]. On the other hand, the design of offline teaching resources is jointly developed by university teachers and enterprise engineers, and a virtual simulation training system of which an intelligent manufacturing production line is developed according to the real production line of the university. Students can log in to the system through intelligent teachers, and complete the cognition of intelligent manufacturing production line, system simulation and construction, system control and operation. The implementation process of each step will be explained and prompted. At the same time, students can also achieve the knowledge of the practice and the ability to advance through the system in the virtual link. The system simulates the game system to achieve real-time scoring and ranking display.

3.3. Process evaluation system

Virtual simulation teaching evaluation reasonably uses the combination of “process + summative” evaluation. Formative evaluation refers to student self-evaluation, group mutual evaluation, teacher evaluation and online learning evaluation, while summative evaluation refers to the theory test and skill assessment. This kind of diversified evaluation from multiple perspectives effectively avoids the problem of the traditional evaluation way of speaking with the result and focuses on the evaluation of the learning process, which plays a powerful role in promoting the overall development of students.

Process evaluation consists of two parts, one is offline evaluation, which is scored and evaluated by students themselves, group members and teachers during the classroom performance and task completion of the evaluation object. The second is online evaluation, which is to evaluate students’ viewing of teaching resources, online discussion and completion of homework, which can be directly retrieved from the platform. In addition, the summative evaluation consists of two parts, the course test and simulation practice. The course test is tested by the online question bank and the offline paper, which is a test of the students’ online learning and offline learning. The online question bank test is divided into two times, and the average score of the two times is calculated while the offline test is given only once. On the other hand, simulation practice is set by the teacher and requires the students to complete the relevant operations in the specified time. The teacher monitors the students’ operations in real-time through the computer teacher terminal and rates them.

4. Conclusions

Through the analysis of the traditional virtual simulation system, in the premise of insufficient summary, the development concept of a virtual simulation system is sorted out and studied. According to the development principle of virtual simulation system, the virtual simulation system of intelligent manufacturing demonstration production line is designed and developed, and it is applied in the course of “Intelligent Manufacturing Technology and its Application.” In the process of practical research, from the students’ learning interest, independent learning ability and other aspects of the students in a year to carry on a comprehensive monitoring of the learning situation, virtual simulation teaching can indeed effectively improve students’ learning performance besides cultivating students’ independent learning ability, improving their learning interest and other aspects are also of great help. Through the use of a learning situation analysis system and teaching behavior analysis software at the same time, it can be seen that virtual simulation teaching is also of great help in improving students’ labor ability and innovation ability.

Disclosure statement

The author declares no conflict of interest.

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