

# **TEACHING REFORM PRACTICE OF "NURSING PRACTICE" SYSTEM BASED ON CDIO**

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## **ABSTRACT**

The teaching mode of CDIO fully reflects the objective law of talent training. Based on the educational concept of CDIO and combined with the actual situation, we optimized the practical teaching system of nursing, and established a diversified and multi-level experimental teaching system of "combining with theoretical teaching and taking ability training as the core". Focus on the process of "step by step, continuous improvement, stratified training and innovation". According to the characteristics of nursing discipline and visual teaching theory, it provides a theoretical basis for the design and implementation of Nursing Practice system, and carries out specific application in combination with Nursing Practice content. By using the system development framework of Unity3d game engine, the learning and practice of nursing knowledge in the simulated training environment are realized. At the same time, the authenticity of the simulated training is increased through various forms such as interactive animation and video playback. By using 3ds Max modeling technology, some professional medical equipment in the project is modeled and manufactured to meet the model requirements in the scene. The elderly are taken as the care object of the simulation training. The user enters the virtual training room through the login system and plays a nursing worker in the training room. The nursing worker needs to communicate with the elderly to evaluate the body of the elderly and choose the correct nursing method to guide the elderly to complete gradually. This optimized teaching system provides a relatively clear teaching guidance in cultivating students' indirect acquisition of knowledge, direct acquisition of knowledge, exploration and research of new knowledge.

## **KEYWORDS**

CDIO teaching concept, Nursing virtual simulation, Curriculum reform, System design,  
Standards:1,7,8.

## **THE NECESSITY OF CURRICULUM REFORM BASED ON CDIO TEACHING MODEL**

### ***CDIO teaching mode***

CDIO is an innovative mode of international engineering education and talent training, which penetrates the "Conceive - Design - achieve - Implement - Operate" education concept throughout all teaching links, organically combines related courses and guides students to actively explore, communicate, cooperate and practice. In order to realize the cultivation of students' independent learning and exploration ability, comprehensive practice and innovation ability, interpersonal teamwork ability, team spirit and professional ethics, it has been used by many educators to guide the reform and practice of vocational education, and has achieved good results (Xu Juanling, 2019). The CDIO concept is integrated into the virtual simulation and visualization teaching of "Nursing Practice", focusing on the construction of discipline knowledge system and inquiring "learning by doing", which is the main teaching method. Integrated curriculum design and practice are carried out, so that students can cultivate their thinking ability and quality in "thinking, doing and speaking clearly". Mainly through course construction, the interrelated course contents are integrated, and a clear course system is formulated. From the selection of virtual simulation subjects, expansion of teaching contents, reform of teaching methods, and effective practice, a reasonable teaching reform and practice path is finally constructed (Zhai Weifang, Feng Juan, Liu Yongli, 2016).

### ***Nursing curriculum reform under CDIO mode***

In order to meet the needs of modern engineering education, it absorbs advanced CDIO engineering education concepts from Europe and America (Zhai Weifang, Feng Juan, Liu Yongli, 2016), combines the characteristics of nursing disciplines and visual teaching theories, and provides a theoretical basis for the design and implementation of nursing practical training system, and carries out specific applications in combination with the content of nursing practical training. By using the system development framework of Unity3d game engine, the learning and practice of nursing knowledge can be realized in the simulation and training environment. At the same time, the authenticity of the simulation and training can be increased through interactive animation, video playback and other forms. Through the use of 3ds Max modeling technology, some professional medical equipment in the project was modeled to meet the model requirements in the scene. Combined with the visual teaching method, students can check the current operation progress during the simulation training, and get the system feedback learning analysis table at the end of all operations, so that they can grasp their own learning situation clearly and intuitively. In the actual Nursing Practice teaching, the care content of the elderly is the main learning content of basic care, so the elderly are taken as the care object of simulated practical training in this curriculum reform system. Users log in the system to enter the virtual training room and play the role of a nurse in the training room. The nurse needs to communicate with the elderly to evaluate the elderly physically. And choose the right way to guide the elderly to complete step by step.

## **THE DEVELOPMENT OF VIRTUAL SIMULATION COURSE OF "NURSING PRACTICE" UNDER CDIO CONCEPT**

### ***System requirements analysis***

Taking the virtual simulation project of Nursing Practice as the carrier, the nursing process of the virtual role for the elderly is regarded as a "product", and the integration of explicit nursing course and recessive nursing course resources, in-class and extracurricular nursing humanistic resources is formed to form an integrated virtual simulation nursing teaching system. Students' personal basic abilities, interpersonal skills and ability to build products,

processes and systems are combined with nursing teaching (Feng Cuiyun, 2021). Cultivate compound talents with high sense of social responsibility and good professional accomplishment by exploiting students' physical and mental potential. The system structure consists of three parts, including the introduction of basic nursing knowledge, nursing knowledge learning, nursing knowledge testing. After logging in to the system, the user enters the training scenario and enters the interaction area in the scenario. The demand analysis of nursing virtual simulation system is shown in Figure 1.

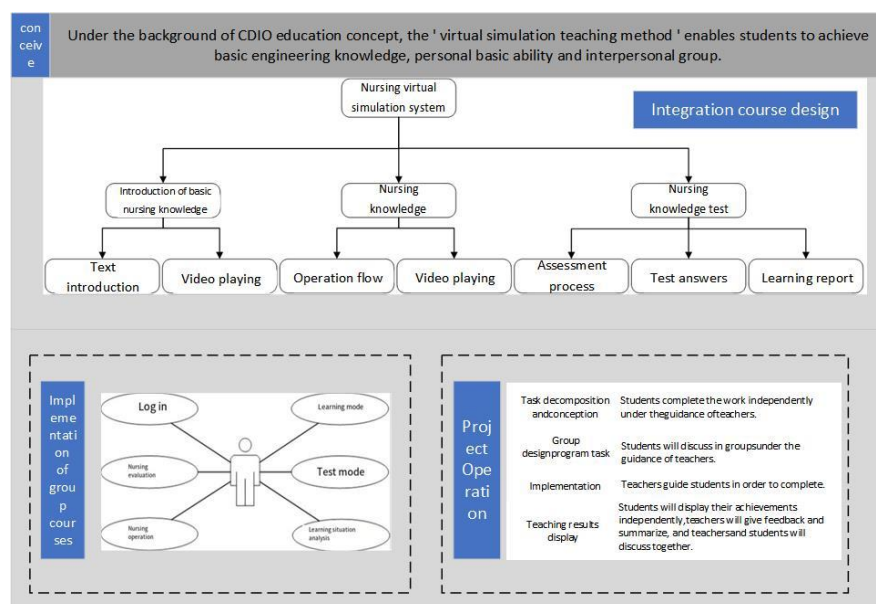


Figure 1. "Nursing Practice" virtual simulation system requirements analysis

Nursing education system of foreign medical colleges is hierarchical management teaching, which is divided into technical secondary school, higher vocational school, university undergraduate and postgraduate students. Different levels correspond to different directions of professional training, curriculum requirements and training targets (Liu Xueqin, 2021). At the same time, foreign medical colleges and universities also have a sound education system for geriatric nursing staff. In professional training, on-the-job training will be conducted according to the work content of nursing staff at all levels, combined with various forms of practical training, and combined with virtual simulation technology and other external equipment auxiliary teaching, so that students can really learn from the practice situation or simulated practice situation. Compared with foreign countries, nursing discipline in our country lacks mature professional teaching system and adequate training facilities, and has not been in large areas to promote the use of innovative technology in practical teaching. The approach of introducing foreign teaching technology and technical resources cannot be based on the development of nursing practical teaching for a long time (Jiang Bo, Zhang Jun, Cao Mi, 2022). Combined with the CDIO education concept and virtual simulation technology and the current development direction and trend of nursing at home and abroad, digital media technology and game engine are used to design virtual training system to help the innovative development of nursing discipline. As shown in Figure 2. Below, a virtualized nursing teaching asset is constructed.

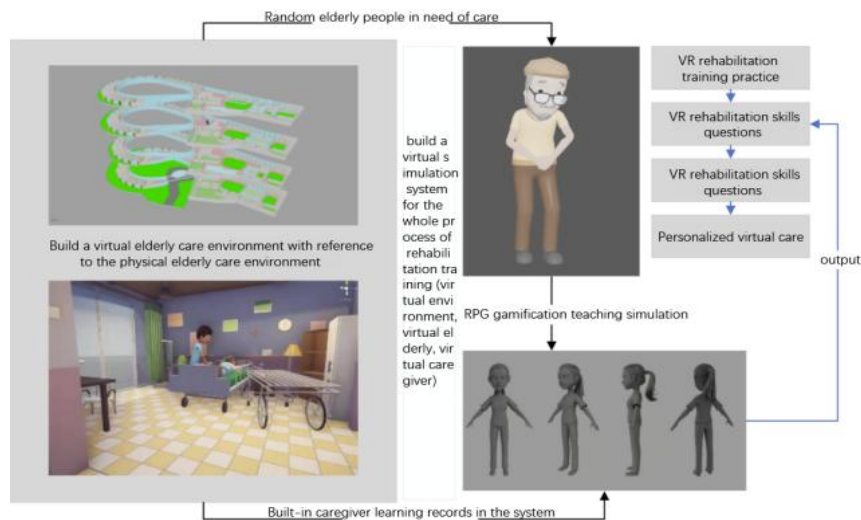


Figure 2. Nursing virtual teaching resources

After entering the interactive area, the user clicks on the ground to move the position autonomously, and clicks on the patient's elderly model to start dialogue and other interactive behaviors. The user behavior function table is shown in Table 1.

Table 1. User behavior function table

Function number	Function name	Functional description
1	Login	Users login by entering the account password.
2	Nursing knowledge learning	Users learn by interacting with the elderly in the scene.
3	Nursing assessment	The user evaluates the patient's condition by talking to the elderly in the scene.
4	Nursing practice	Users carry out nursing practice through evaluation conclusions.
5	Nursing knowledge test	Users can switch to test mode in the scene.
6	Learning situation analysis	Users can view the learning situation of each part at the end of the process.

Combined with the CDIO education concept, the nursing knowledge points are sorted out as follows :

#### *Analysis of nursing basic knowledge introduction module*

In this module, the user conducts a preliminary assessment of the patient's physical condition through the text information in the simulation training dialogue, conducts inquiries through the description of the elderly in the scene, prepares before operation, formally operates, and informs after the operation. This series of nursing operations complete the introduction of basic knowledge.

### *Analysis of nursing knowledge learning module*

After entering the scene, the user begins to learn the mode. After controlling the caregiver in the scene to enter the interactive area, he interacts with the elderly in the bed, evaluates the physical condition of the elderly by asking the elderly, and guides the elderly to cooperate with the nursing operation. In this process, learning is carried out through interactive methods such as picture demonstration and playing practical teaching video.

### *Analysis of nursing knowledge test module*

After the user enters the scene, the test mode is manually turned on. After the test mode is turned on, the user informs the user after the inquiry, pre-operation preparation, formal operation, and end of the operation. This series of processes will increase the interference options of wrong operations to mislead the user to achieve the purpose of test learning.

### ***Reform path based on visual teaching***

Visual teaching refers to the use of a series of diagrams or real-time feedback information to visually display invisible thinking processes and methods, so that they can be visually presented to users in a way that is easy to understand (Chen Lijuan, 2022). Using this method to process learning resources can stimulate users' audio-visual senses and enable them to obtain more language and image information. More conducive to stimulate users' interest in learning, and improve the efficiency of learning complex knowledge.

In this project, users can view the current process progress in real time in the operation process, and after completing the operation of learning mode and test mode, they can view their own learning analysis. The performance of each part of the user is presented in the form of charts, and the abstract is presented intuitively in the form of data. In this way, users can clearly understand their own knowledge learning and weak links, so as to strengthen the study of weak links (Li Chunhong, Hu Huimin, 2021). On the other hand, users change from passive receiving of knowledge to active targeted learning, which improves users' autonomous learning ability.

## **PROJECT-BASED BLENDED TEACHING OF NURSING UNDER CDIO MODEL**

### ***"Nursing Practice" virtual simulation learning platform construction***

The demand analysis of the functional modules of this project, as well as the analysis of the design principles of this project, the basic operation process of the system has been improved. The virtual simulation system of "Nursing Practice" is divided into five modules : learning module, test module, nursing preparation module, nursing operation module and knowledge network module. The operation process of this project is summarized as follows : the user enters the account password to log in to the system. If the account password is entered incorrectly, the system will give a prompt, and the login is successful after entering the correct input, entering the training room scene. The entry scenario defaults to the learning mode, and the user can manually switch to the test mode. In the learning mode or the test mode, the user performs nursing preparation and nursing operations on the elderly in the training room and the follow-up work after the operation is completed. The user can view the current process progress, and finally generate a learning situation analysis report for the user. The system flow chart is shown in Figure 3.

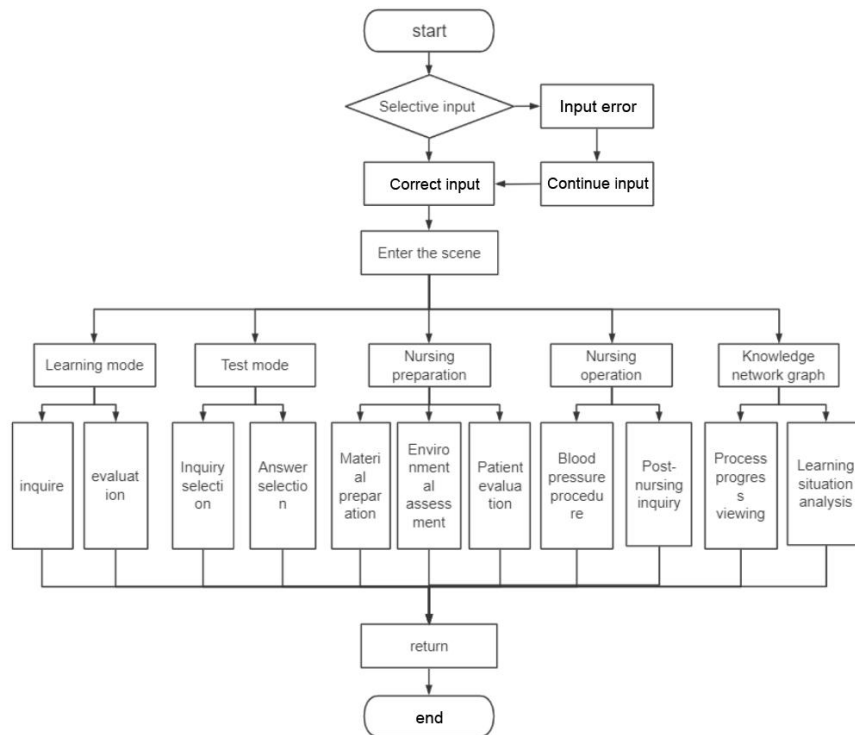


Figure 3. System flow chart

The virtual simulation system of "Nursing Practice" consists of five functional modules. The functions of each functional module are designed according to the characteristics of the nursing profession and the learning characteristics of the student users. The specific functions are described as follows :

### *Learning module*

This module is mainly based on simulated practical training, and completes the inquiry and evaluation process by realizing interactive dialogue, click effect and other functions. When the user enters the scene, the default mode is the learning mode. The user clicks the ground control to simulate the movement of the nursing worker into the interactive area. When the mouse cursor moves to the old man, the name of the old man appears. After the mouse is removed, the user disappears to guide the old man to carry out relevant nursing operations through dialogue with the old man.

### *Test module*

This module is mainly based on simulation training test, and has the same operation process as the learning mode.

After entering the scene, the user can use the mouse to switch the system mode to the test mode at the top of the interface. After the switching mode, the user enters the interactive area and begins to talk with the elderly. During the dialogue, there will be error options that interfere with the user's answer. At the same time, there is a countdown function to prompt the user in the form of a progress bar for the remaining time.

### *Nursing preparation module*

This module focuses on the preparation work before formal nursing. Its functions include patient assessment, environmental assessment, and product preparation.

The user makes assessment and judgment on the patient's inquiry, and judges the nursing operations required by the patient according to the assessment results. Before the operation, the user performs seven-step washing techniques and wears a mask, then jumps to the material preparation room according to the patient's nursing needs, selects the equipment to be used and puts it in the inventory, and then returns to the training scene to evaluate the environment by controlling and triggering the camera animation and character animation.

### *Nursing operation module*

This module begins to formally carry out nursing operations, including hot spot interaction, play video, assist the elderly to make correct nursing posture, nursing inquiry.

After the preparation work is completed, the user will ask the elderly about smoking and rest, check the elder's information and inform the elderly about the nursing operation after meeting the nursing requirements, guide and assist the elderly to lie down through dialogue, and then watch the video of the operation process of blood pressure measurement according to the flashing hot prompts on the blood pressure meter, and inform the elderly after the operation, and conduct the post-nursing inquiry.

### *Knowledge network graph module*

This module takes visual teaching as the core, including the function of viewing the process progress and generating the analysis chart of learning situation. When you enter the scene, you can see the current process progress at the top of the interface. The complete process progress includes: inquiry, preparation before nursing, conversation before operation, assessment before operation, formal operation, and notification after operation. After the user is informed of the operation, the system displays the learning status analysis table. You can move the mouse cursor to the corresponding item to view the score.

### ***"Nursing Practice" virtual simulation learning mode and results***

The learning mode is realized by using the code logic programming in AC framework. First, the mouse event is created, the dialogue appears when the mouse clicks on button, and the figure moves when the mouse clicks on the ground. Then, the dialogue process module is created, and the process is: inquiry, preparation before blood pressure measurement, menu of continuing conversation before operation, menu of pre-operation stage, and menu of formal operation of blood pressure measurement. Finally, the dialogue sequence should be configured according to the dialogue content, and the switching mechanism should be set. When switching from test mode to learning mode, the logical sequence should be switched synchronously. This module realizes the function of selecting the icon of corresponding medical device from the item warehouse on the left side of the interface to the item bar on the right side in the item preparation area. The effect picture of the item preparation function is shown in Figure 4. The object preparation function is similar to the backpack pickup function. The mouse event is created first. When the mouse clicks "Object preparation", a black screen transition animation appears and jumps to the object preparation room scene, and "Item Warehouse" and "Select Item bar" pop up in the interface. The icon will recognize the coordinate position of the mouse to realize that the icon follows the mouse. The mouse clicks the space in the item bar on the right to place the icon to complete the preparation of equipment. Finally, click the back button in the upper right corner to jump to the scene of the ward. This function is implemented through the code logic programming in AC framework.

First, the mouse event needs to be created. When the mouse clicks the interactive button in learning mode and test mode during operation, the system will calculate the data according to the script logic, and the learning situation analysis will pop up at the end of the process. Answering speed, operating accuracy, preparation accuracy, conversation accuracy, question and answer accuracy.



Figure 4. Required item preparation function renderings

Based on visualization technology, users can intuitively see their learning situation of each part in this study or test. The learning analysis function is shown in Figure 5.

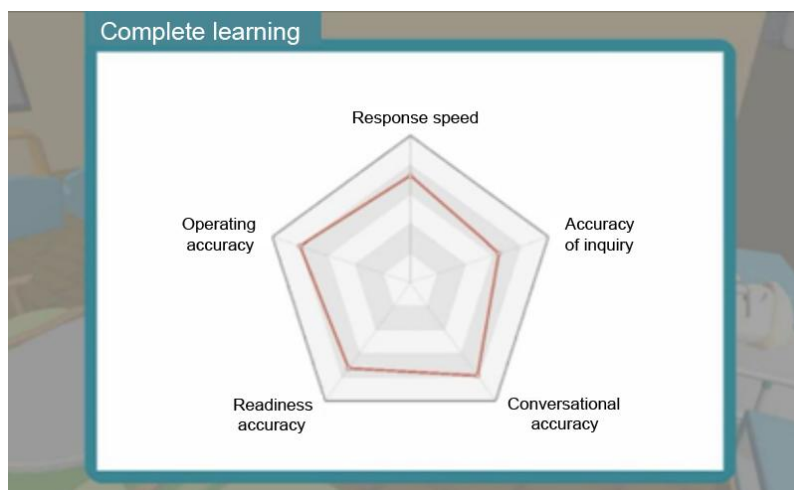


Figure 5. Visual learning outcomes

## SUMMARY AND APPLICATION PROSPECT

In the total and implementation of the virtual simulation system of Practical Training of Nursing Science, the basic needs of the project are determined through a large number of research in the early stage of the project, and the production plan of the project is preliminaries determined: the simulation nursing operation is carried out according to the real nursing situation and the elderly nursing group facing the largest number of users. In the middle stage of the project, Unity3d game engine was used as a development tool to simulate a number of nursing operations such as inquiring and evaluating caregivers, and the system was divided into two modes: learning mode and testing mode, to investigate whether



users could choose the right nursing operations under the same situation. At the same time, three-dimensional modeling technology is used to model professional nursing equipment (Liu Shumei, Li Lihua, Lu Junhua ,Lang Yuling, 2020) : medical instrument vehicle and nursing bed. In the modeling process, physical information is referred to and data collected in the previous investigation is combined to complete the modeling. In the later testing stage of the project, through repeated testing of the system's operation effect on different equipment, continuous optimization, and finally got a product with strong system stability, to ensure better results in the final practical teaching of the project.

The reform of teaching mode based on CDIO education concept can improve the learning participation and academic performance of nursing students, effectively enhance their sense of learning self-efficacy, promote the cultivation of comprehensive ability of nursing students, and evaluate the teaching effect well. However, it is still necessary to further explore and practice how to reasonably introduce CDIO teaching philosophy into the teaching reform of nursing curriculum and realize the cultivation of modern nursing talents by combining the characteristics of different practices' images, teaching and learning contents and teaching and learning objectives (Li Jinmei, Wang Ying ,Chen Min, 2009).

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