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# Analysis Of the Path of Integrating Medical Humanities Education into Medical Virtual Simulation Experiments

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**Abstract: With the continuous advancement of digital teaching, virtual simulation experiments have become an important method of medical education. They can be used to achieve functions such as sharing high-quality resources, updating content, and cultivating students' practical skills. This article discusses the combination of "medical humanities education" and virtual simulation experiments. At present, the main problems of integrating medical humanities elements into virtual simulation experiments are: incomplete curriculum design, lack of guarantees, high costs, and lack of evaluation systems. The survey found that the coverage of medical humanities content in virtual simulation experiments is currently low, and teachers lack the cognition and ability to integrate humanities education into it. In order to better cultivate the medical humanistic spirit, it is necessary to strengthen humanistic care, ethics education, and communication skills training in the virtual simulation experiment process, so that medical technology and medical humanistic spirit can be integrated with each other, and talents with both professional skills and humanistic care can be cultivated to achieve high-quality and sustainable development of medical education.**

**Keywords: Virtual Simulation Experiment; Medical Humanities Education; Path; Integration of Medicine and Literature**

## 1. Introduction

The 2022 National Education Work Conference clearly deployed the strategic action plan for digital education [1], accelerating the construction of digital teaching, which plays a strategic role and driving force in promoting the modernization of education. Through digital teaching, the informatization and intelligence of online education can be realized, and the balanced distribution of educational resources can be promoted. The traditional teaching model can no longer adapt to the teaching needs of the new era. In virtual simulation experiment (hereinafter referred to as "virtual simulation") teaching, the shortcomings of traditional teaching can be made up and the rational combination of experimental teaching resources can be achieved. The virtual simulation experimental teaching project in the new era has three major functions: first, it enriches the content of experimental teaching and optimizes the form of experimental teaching; second, it solves some traditional experimental projects that were "unable to be done, impossible to do, and impossible to do" in the past; third, it combines theory with practice and cultivates students' innovation ability and practical hands-on ability. The three functions of virtual simulation experimental teaching projects in the new era are as follows: First, virtual simulation teaching projects break through the time and space constraints of traditional experimental teaching. Based on virtual simulation experimental projects, information technology is used to transform experimental teaching projects, solving the problem of "cannot be done, cannot be done, cannot be done" in traditional experimental projects, and providing a carrier for students' operations [2]. Second, through virtual simulation teaching, the form of classroom teaching can be transformed, allowing students to have a sense of participation and gain, and combining theory with practice to promote the development of students' innovative and creative abilities; third, the use of information technology in virtual simulation classrooms can promote the professional development of the teaching staff. Based on the application of virtual simulation experimental teaching projects, existing resources can be fully utilized to effectively improve the quality of experimental teaching

and promote the improvement of teachers' own professional capabilities and scientific research levels [3]. At the same time, virtual simulation experimental projects are also an important part of realizing the reform of education and teaching models.

In September 2024, the National Health Commission issued the “Action Plan for Improving Medical Humanistic Care (2024-2027)” (National Health Commission Medical Emergency [2024] No. 18), which clearly pointed out that “ideal and belief education, ideological and political education, and medical ethics training should be integrated into the entire process of medical talent training, and efforts should be made to cultivate the spirit of cherishing life, being a doctor with sincerity, and saving the dying and the wounded in medical students. Strengthen medical humanistic education, optimize the medical humanistic curriculum system, and build a strong medical humanistic teaching staff”. In the medical higher education link, it is necessary to attach importance to the teaching of medical theoretical knowledge and the practical teaching link. It is necessary to strengthen the role of role models, practice bases, and action guidance in the medical practice link, and at the same time, to understand their value concepts through contact with patients and their families. In medical education, students should be trained to contact patients and experience the true meaning of medical humanities, so that they can truly incorporate the skills to be mastered and the principles to be followed into their own body and mind. This is of great significance for cultivating students' clinical operation ability and humanistic care [4]. Therefore, how to integrate medical humanistic education into medical virtual experiments has become an urgent problem to be solved.

## 2. Status Quo

### 2.1 Ilab-X

The term "visual simulation" (VS) lacks a clear definition; it is generally used to describe different forms of VS in terms of fidelity (realism), immersion (interactivity), and presentation method (e.g., video or avatar). This article uses the term VS to refer to platforms based on virtual reality (VR), augmented reality (AR), or educational games (SG). In 2017, the Ministry of Education issued the "Notice on the Development of Demonstration Virtual Simulation Experimental Teaching Projects from 2017 to 2020" (Ministry of Education [2017] No. 4), specifying that approximately 1,000 demonstration VS experimental teaching projects would be recognized by 2020. By 2024, the National Virtual Simulation Experimental Teaching Project Sharing Platform (hereinafter referred to as the " ilab - x ") had launched 2,882 VS experimental courses, including 1,192 nationally recognized ones.

There are 671 medical virtual simulation experiments on ilab - x, including 188 national first-class courses, 232 provincial first-class courses, and the remaining 251 are other types of experimental courses. These experiments comprehensively cover 916 courses and 5930 knowledge points, and completely cover all courses in professional categories such as Chinese medicine (28), Chinese medicine (54), basic medicine (154), clinical medicine (137), oral medicine (22), public health and preventive medicine (75), pharmacy (45), forensic medicine (14), nursing (83), medical technology (55), and integrated Chinese and Western medicine (6), which can meet the needs of different majors. In terms of experimental type, there are 240 basic practice experiments, 375 comprehensive design experiments, 49 research and exploration experiments, and 2 other types of experiments. According to the category of courses, there are 10 public courses, 367 professional foundation courses, 280 professional core courses, and 12 other courses, which have built a complete medical virtual simulation teaching system.

### 2.2 Problems

Statistics were collected on the medical virtual experiments "experimental teaching process and experimental methods" and "experimental steps" on the shared platform. The number of medical virtual experiment projects involving medical humanities keywords such as "doctor-patient communication" and "medical ethics" was zero. There were two projects that included "humanistic care" experimental steps: one was the "virtual simulation project based on the combination of intelligent digital patient comprehensive puncture and humanistic care", and the other was the "virtual simulation experiment of gastric lavage operation and its humanistic care". Thus, we can see that there are some problems with integrating medical humanities education into medical virtual

simulation projects: First, the coverage of the projects is limited, with only Central South University (Project 1) and Zhengzhou University (Project 2) offering them. Virtual simulation experiments at other undergraduate and junior college institutions do not incorporate medical humanities education content; second, the number of projects is small, with only two projects and uneven distribution, reflecting that some medical schools have not paid enough attention to the issue of prioritizing practice over medical humanities elements when developing projects; third, the level of recognition: only one is national, and the rest are provincial and ministerial; fourth, in terms of student evaluation, although the shared platform experiments are free and open to use, Project 1 scored 4.5 and Project 2 scored 4.4, indicating low recognition. Human-computer interaction and hands-on experimental practice need to be strengthened; fifth, user participation: the number of participants and the number of participants in Project 2's online experiments are both zero, while only 636 people have participated in Project 1's experiments since its launch. Therefore, it is necessary to focus on user needs to enhance the learning experience and stimulate user enthusiasm. Therefore, there is still considerable room for improvement in achieving "medical humanities integration" in virtual simulation experiment teaching.

**2.3 Causes**

From October to December 2023, this study conducted a questionnaire survey of 191 medical faculty members who had used virtual teaching. The survey aimed to explore the effectiveness of integrating medical humanities into current medical virtual teaching in universities and to provide insights into how to achieve "medical humanities integration" in future virtual teaching. The questionnaire consisted of 22 multiple-choice questions. The first section collected faculty personal information (10 questions), including information on the courses they teach, their employer, and their work schedule. The second section used a Likert-type scale, with questions including satisfaction with the integration of medical humanities into their teaching (6 questions) and satisfaction with the implementation of their teaching (6 questions). The third section surveyed faculty members' needs for improving the integration of medical humanities into their medical virtual teaching (3 questions), including information on required resources and support. Analysis of the questionnaire revealed that current faculty and student satisfaction with the integration of medical humanities into medical virtual teaching in universities is low, with an average score of 3.417 (out of 5). The main reasons are as follows:

2.3.1 Insufficient integration effectiveness at the curriculum design level

Among the 191 instructors currently designing medical virtual experiment courses, 71.2% focus on virtual simulations of medical expertise, overlooking the importance of integrating medical humanities education into the medical teaching process and failing to organically integrate medical humanities education with medical expertise. Furthermore, when integrating medical humanities education into virtual experiments, 60.73% of instructors fail to fully explore the various humanistic value points in the cases, fail to understand students' true needs, and neglect the practical requirements for improving students' humanistic literacy. This results in insufficient integration of medical humanities education into virtual experiments, making it difficult to achieve the goal of cultivating students with both medical humanistic sentiments and medical professional literacy.

2.3.2 Lack of resource guarantee and management support

62.827% of teachers believe that there are certain difficulties in integrating medical virtual experiments into medical humanities education. The main reasons are: limited resources and management factors, insufficient funding affects the funding for virtual experiment projects that have both medical professionalism and humanistic connotations, and it is impossible to attract more professional people to carry out in-depth development (62.83%); there is no staff specifically responsible for medical humanities education and virtual experiments to organize and coordinate curriculum construction (61.26%); corresponding experimental projects are carried out separately within each major, and there is no opportunity for cross-disciplinary docking to integrate the resources of various majors (65.46%); there is a lack of inter-school sharing mechanism to break down professional barriers, which is prone to duplicate construction problems (57.59%), which will have a negative impact on the development of medical humanities education in virtual experiments and

the full utilization of resources.

2.3.3 Project costs constrain the sustainability of integration

The development and maintenance costs of medical virtual experiment software are already high. If integrated with medical humanities education, further refinement of case studies, scenario creation, and interactive design for specific knowledge points may be necessary, which can be a significant expense. For example, the development and maintenance costs of a basic medical virtual experiment project are approximately 40% higher than those of non-humanities-integrated solutions. If funding is limited, universities or programs with such projects continue to face significant pressure, making them difficult to implement regularly and sustainably.

2.3.4 Poor integration effect in the teaching process

47.644% of teachers believe that current evaluations of medical virtual experiment teaching lack an assessment of the integration of medical humanities education into students. Most experiments lack quantitative indicators for improving students' humanistic literacy, relying solely on formative evaluation methods such as simple text descriptions or group discussions. This fails to effectively assess students' growth in medical humanities knowledge, attitudes, and values. There are no scientific standards or norms for integrating medical humanities education into course content and for effectively teaching their own courses. This leads to disorganized and arbitrary teaching, hindering the in-depth integration of medical virtual experiments and medical humanities education, and hindering the improvement of teaching quality.

## 3. The Application of Virtual Experiments in Medicine

To promote the deep integration of medical virtual experiments with medical humanities education, it is necessary to fully understand the various virtual experiment projects currently in widespread use in the medical field. These virtual experiments encompass a wide range of formats, including simulated surgical procedures, clinical diagnosis, and case analysis. They not only provide an immersive practical experience but also effectively address the lack of practical resources in traditional teaching. By thoroughly studying and understanding the design concepts, technical features, and application results of these virtual experiments, educators and researchers can more specifically incorporate elements of humanistic care and ethical considerations into virtual simulation platforms, thereby promoting the development of medical education towards a more humanistic and practical approach.

Virtual simulation (VS) is a new and flexible simulation teaching method that can achieve standardized education and teaching. "Immersiveness" is the core concept of VS. VS is a computer-generated world that includes immersiveness and tactile feedback. Medical simulation based on VS benefits both medical learners and educators by providing access to diverse learning materials. VS can be standardized and uploaded to a virtual environment, with embedded assessment metrics and feedback. VS also allows medical students to virtually experience relevant content at any time and place using VR technology. They can freely move and change their physical states without the need for VR equipment. VS can also encourage students to make mistakes without compromising patient health, allowing them to correct their mistakes promptly through targeted training, ultimately enabling students to become practitioners.

Based on the above needs, many medical schools currently use various virtual experiments to improve the learning effect of various surgical procedures, especially to improve the education and skills level of surgical procedures [5]. VR and AR create an enhanced learning environment that can improve students' enthusiasm and participation, enhance the expression of spatial knowledge, improve the contextualization of learning, and cultivate excellent technical skills. The realism, interactive potential, and user immersion of the three-dimensional virtual environment will affect the training effect. Different types of virtual experiment teaching meet the different ability needs of medical students.

### 3.1 Virtual Standardized Patient

With the increasing use of virtual standardized patients (VSPs) in medical education, training using SG platforms has become a crucial tool for enhancing medical students' situational awareness. These platforms leverage advanced automatic speech recognition and natural language processing technologies, enabling

trainees to engage in natural language conversations with VSPs, rather than being limited to selecting pre-set questions. This interactive approach enhances the authenticity of communication, but the accuracy of VSP responses is still affected by case complexity. This accuracy is improving with technological advancements. VSPs can realistically simulate clinical scenarios, providing medical students with examples of real-life patient presentations and ensuring a high degree of consistency between virtual environments and actual clinical practice. They are invaluable in assessing patient communication, history taking, differential diagnosis, clinical decision-making, and patient education. Compared to traditional standardized patients, VSPs offer precise stimulus control, flexible operation, and unrestricted time and location, resulting in more reliable and unbiased assessment results [6].

This article lists 13 unique medical VSP teaching platforms, each with distinct features, including interaction styles, communication skills development, and specialized focus. Among them, the Acute Myocardial Infarction VSP Simulator (https://www.ilab-x.com/), the Pneumothorax ESP Simulator (https://www.ilab-x.com/), the COPD Virtual Patient Simulator (https://www.ilab-x.com), and the University of Southern California Standard Patient (www.ict.usc.edu) are all single-player platforms. The first three utilize text-based communication, while the latter offers free text. All focus on medical history taking, differential diagnosis, and treatment selection. Simtabs© (www.simtabs.com), I-Human Patients (www.i-human.com), Anesoft (http://anesoft.com/), HeartCode (www.cpr.heart.org), and Mursion (https://mursion.com) are also single-player platforms. Simtabs© and HeartCode offer optional communication capabilities, I-Human Patients supports branching decisions and allows multiple accesses, Anesoft is non-communication-friendly, and Mursion allows verbal communication. Each platform focuses on different areas.

Unity 3D (https://unity3d.com), Second Life (http://secondlife.com), and Clinispace© (http://virtualsimcenter.clinispace.com) are multiplayer platforms. The former two offer verbal communication, while Clinispace© has team members acting as patients. Second Life is an open source platform. Virtual Heroes (www.virtualheroes.com) supports single-player and multiplayer modes, offers selectable communication capabilities, and focuses on pre-hospital team training and disaster management. These platforms also demonstrate the many possibilities of VR in the medical humanities.

### 3.2 Emergency (EM) Simulation Experiment

Regarding medical student assessment, research on virtual lab technology has primarily focused on surgical and procedural specialties, but its application in internal medicine clinical practice is limited. Recently, international research on the use of virtual lab technology in emergency medicine (EM) has been increasing, with its use increasingly serving as a formative assessment method. A pilot evaluation of virtual labs in the emergency department demonstrated that ED residents with the same expertise and skill level achieved similar results in both traditional assessment methods and virtual lab settings, with no significant differences in team leadership or trauma management of advanced life support units (ALTs). Furthermore, the evaluation covered key behaviors and eight competency indicators, one of which was emphasizing the importance of communication reinforcement in virtual lab settings. First aid educators need to explore how to most effectively utilize virtual reality technology. Virtual experiments, which enable multidisciplinary and multi-professional simulations and reporting, also prioritize cross-disciplinary communication within medical teams. Furthermore, the development of technologies like artificial intelligence and natural language processing facilitates the evaluation of communication and interaction within medical teams. By leveraging artificial intelligence to optimize the design of virtual experiments conducted by multi-person teams, a scientifically effective assessment method combining multiple technologies, including artificial intelligence and natural language processing, can be developed. As a core element of virtual experiments, both domestically and internationally, it is crucial to carefully design and implement the program based on the specific scenarios and analyze relevant domestic and international standards and regulatory literature. Furthermore, developing assessment tools for training effectiveness and fairness based on this foundation is crucial.

Virtual reality technology is well-suited for training in high-risk, low-frequency events, including disasters and mass casualty events,

such as those dealing with chemical, biological, nuclear, and explosive agents. Specifically for mass casualty event simulations, virtual experiments can achieve the same educational objectives as traditional experiments while allowing for repeated practice of these skills. Similarly, virtual experiments can provide formative assessments of rarely encountered clinical events or procedures. Given their potential for assessing non-procedural clinical skills such as emergency management and clinical decision-making, virtual experiments may be an ideal tool for assessing the higher-order cognitive skills required for triage, prioritization, and multi-patient management in the emergency department.

### 3.3 Game-Based Learning

With the rapid development of VR technology, highly immersive virtual simulation experiences are now possible at a fraction of the cost of earlier systems. However, providing users with realistic and effective tactile feedback remains a key challenge in developing such applications. Tactile perception plays an irreplaceable role in learning, helping users perceive the properties of physical objects and obtain near-realistic force and resistance feedback when manipulating them. Particularly in procedurally intensive fields such as medical education, a lack of precise tactile perception means students cannot sense the force applied by a scalpel or tissue resistance during surgery, hindering skill acquisition. Electromagnetic technology has shown promise in tactile training, 3D virtual simulation, augmented reality (AR), and other visualization applications. However, traditional mannequin learning (MBL) and procedural virtual simulation (VS) remain limited in tactile implementation and cost control. In comparison, game-based learning (GBL) solutions—including single-player (Single GBL) and multi-player (Multi GBL) models—offer advantages in terms of tactile experience and overall cost. In the future, virtual simulation platforms need to further enhance their mobility and ease of deployment to expand their audience coverage. Teachers should also explore more efficient and economical content development and sharing mechanisms to promote the popularization of the platform.

At the same time, gamified learning (GBL) is gradually incorporating perceptually adaptive mechanisms to enable dynamic assessment of student performance. This mechanism can adjust the content and difficulty of subsequent virtual experiments in real time based on learners' responses to past actions and context, thereby providing highly personalized learning paths. This adaptability not only improves assessment accuracy but also enhances the pedagogical relevance of virtual reality systems. While developing such adaptive virtual learning platforms presents challenges in terms of technical complexity and resource investment, their potential for formative assessment and personalized learning support is significant. GBL models offer unique advantages in interactivity, collaboration, sensory experience, immediate feedback, and accessibility flexibility. Multi-GBL models, in particular, excel in team collaboration and distance learning scenarios, while Single-GBL models support self-paced learning and augmented reality capabilities. Furthermore, GBL models are generally mobile-compatible, accessible 24/7, and have low maintenance costs, enabling efficient, flexible, and cost-effective virtual simulation applications in a wider range of education and training scenarios.

In summary, virtual experiments are beneficial for advancing medical education. In the future, while improving medical technology, we should also incorporate medical humanities education to cultivate empathy and foster patient-centered values in medical students. While enhancing experimental realism, technical proficiency, and the clinical practice abilities of medical students, we should also consider related logistical support and ethical issues. We need to increase collaboration with software engineers and clinicians to design virtual experiments that reflect a medical humanities perspective, equipping medical students with both solid medical skills and a deep compassion for their patients.

## 4. Integration Analysis

Virtual experiments offer an innovative approach to fostering high levels of collaboration and teamwork in clinical practice. Whether conducted in small or large groups, virtual experiments effectively promote interaction and collaboration among students and are an ideal tool for improving clinical collaboration skills. Several key factors should be considered when designing medical virtual experiments: First, a software platform that

supports real-time multi-user interaction should be employed to ensure synchronous communication and collaboration among team members. Second, a balance should be made between synchronous and asynchronous learning methods to meet diverse teaching needs. Third, students should clearly define their roles, understand their responsibilities within the virtual team, and become familiar with the roles of others to enhance teamwork. Finally, the design of virtual experiment scenarios must be validated by professional knowledge to ensure the authenticity and practical value of the scenarios, thereby providing a simulation experience that aligns with clinical reality and truly achieving the deep integration of virtual experiments into medical education.

### 4.1 Integration Principles

The integration of virtual experiments into medical humanities education emphasizes not only focusing on technical implementation but also on their role in humanistic care and value formation. To this end, it is necessary to establish integration principles to ensure that virtual experiments become an effective tool for promoting medical humanities education.

First, technical support is essential. If students encounter technical difficulties in virtual simulation experiments, it is easy to affect their learning investment and experience satisfaction (Verkuyl, 2024) [7]. Therefore, it is important to start with simple imitation, gain a "trouble-free" experience in the virtual environment, and gradually get used to this virtual situation. No matter how thorough the preliminary preparation is, technical problems will always occur. It is very important to provide timely and rapid support for technical failures. If necessary, the virtual simulation development team and the institution's technical department can be equipped with dedicated technical support personnel to solve technical problems.

At the same time, teachers' technical mastery and guidance skills are particularly critical in medical humanities education. Teachers' confidence in virtual simulation can enhance students' sense of security and engagement (Fiedler, 2014) [8]. Therefore, teachers should continuously improve their own skills and further enhance their ability to familiarize themselves with and guide students in using virtual simulation tools through training courses, professional certificates, or team-based practical training projects on and off campus. This will also help promote students' understanding of the medical humanistic spirit and its application in virtual environments.

To improve proficiency in virtual simulation technology, the following measures are necessary: allocate dedicated time for teachers and students to familiarize themselves with the virtual simulation platform and tools, improving their hands-on skills; through detailed introductions and demonstrations, enable students to understand their learning tasks and processes, understand the teaching objectives achieved by using relevant technologies, and reduce operational errors caused by using technology; track common problems and compile the problems encountered and their solutions into a booklet to facilitate resolving confusion during student use later; through pre-teaching special courses, allow students to have early access to virtual simulation laboratories, help students relieve anxiety and resistance, allow students to adapt to the virtual simulation environment as soon as possible, and more effectively utilize the resources of the virtual simulation experimental platform to carry out learning. This will ensure the smooth implementation of virtual simulation experiments, and through the integration of virtual simulation technology with medical humanities and ethics, achieve the goal of transforming virtual experience into a technical carrier for cultivating medical benevolence, optimizing learning experience, and promoting the formation of good values.

### 4.2 Integration Process

For different technologies, disciplines, and various virtual experiment structures, integrating medical humanities into virtual experiments requires more than simply inserting them into the experiment. It requires careful consideration of whether the experimental process will contribute to the learning of the course. Specifically, it requires consideration of whether it can enhance students' understanding of medical professional ethics, humanistic care, and human nature. During the teaching process, teachers should rationally plan specific steps, including pre-class guidance, immersive in-class experiments, post-class debriefing, reflection, and full evaluation. Furthermore, attention should be paid to infusing this process with humanistic values, ensuring that virtual

experiments not only demonstrate and impart skills but also cultivate a medical heart, ethical awareness, and empathy. Only in this way can the two be effectively connected to achieve optimal results.

4.2.1 Preliminary description

Pre-experimental briefings in medical humanities education can provide students with foundational information and help them understand and appreciate the cultural and ethical implications, fostering a sense of safety, respect, and trust. Pre-experimental briefings are conducted before the virtual experiment begins. They explain the overall scenario and process, as well as the importance of humanistic care, to prepare students. This foundation allows students to fully understand the ethical considerations, role-playing, and communication elements inherent in the simulated environment. This allows teachers to lay a solid foundation for students before virtual experiments begin, fostering empathy and a sense of responsibility, fostering humanistic learning, and enabling them to successfully and safely complete the virtual experiment.

The pre-instructions are to scientifically describe to students how to conduct virtual experiments and make them understand their purpose and expected results. This section should inform students at the beginning of the course about the purpose and content of entering the virtual simulation and the requirements for medical humanities spirit put forward for medical school teachers and students; introduce information such as the background of the virtual scene, ethical principles, role settings, communication rules and confidentiality requirements; and propose the academic and humanistic goals of the experiment, such as cultivating the doctor's benevolence and learning to empathize with the patient's feelings. Teachers are required to clearly introduce the equipment to be used and the technical means to be mastered, and ensure that every student is fully prepared. At the same time, they should pay attention to classroom discipline and create a good learning atmosphere [9].

Effective pre-explanation can achieve many goals: first, it allows teachers and students to form a harmonious and trusting interactive atmosphere, strengthens the concept of humanistic care, and allows students to feel spiritual comfort and a sense of security in virtual experiments; second, it allows students to understand that virtual practice exercises are not just for the purpose of acquiring skills, but also for constantly practicing professional ethics and cultivating their empathy throughout the process; third, it allows students to clarify the social, ethical, and cultural background, so that students can more clearly realize that when doing such exercises, they must have a certain degree of sensitivity to the complex and diverse social realities in virtual situations, abide by relevant laws and regulations, strictly implement various confidentiality systems, and respect the privacy of virtual characters; fourth, after effective explanations, it can also enhance students' participation and desire to explore, actively ask questions, not be afraid of making mistakes, dare to try, and be brave to express themselves.

Specifically, teachers can use standard explanatory materials to provide consistent and sufficient information to everyone, so that all participants can understand the humanistic background and ethical significance of the virtual scene, the behavioral requirements and rules of the participants and the scene; tolerate the occurrence of mistakes and encourage students to learn lessons after making mistakes; at the same time, students should also be told that they need to keep secrets, protect the privacy of virtual characters or patients, and safeguard everyone's interests. Before starting, students should be made aware of the specific learning objectives and emotional objectives so that they have a clear grasp of the main learning content of this task. If the experiment involves data collection or the entire learning process is recorded, students must be informed in advance, because only when they are informed will students fully cooperate. The specific experimental instrument usage process, preparation methods, audio and video equipment selection and operating specifications must be explained, and precautions should be set. Inform students of the corresponding content before class, so that students can be familiar with the duration and location of the entire virtual experiment in advance, which can make the entire experimental class smoother.

4.2.2 Implementation

When it comes to promoting the integration of medical humanities education into virtual experiments, the key lies in the practical aspect. Virtual teaching methods can be implemented through a variety of means, including 2D/3D computer simulations, full/semi-immersive

methods (such as VR headsets and Android phones), and real-time remote simulation platforms (web conferencing platforms). Different virtual learning experiences can be selected based on students' actual needs and the requirements of medical humanities education, ensuring that students can better cultivate ethical thinking, empathy, and communication skills through simulation experiments.

Choosing the right type of virtual experiment is crucial, as different technologies and platforms significantly impact teaching. When selecting application software, teachers should consider both its suitability for the required teaching environment and its ability to achieve the goals of medical humanities education. This ensures that students have a trouble-free experience while conducting virtual experiments, thereby increasing their enthusiasm for participating and their satisfaction with the project.

The various types of virtual experiments and their selection considerations provide guidance for faculty to design virtual activities tailored to the humanities themes of their courses. To reduce the teaching workload, it is recommended to use existing, easy-to-use, and proven virtual platforms to ensure the reliability and practicality of teaching tools. Before incorporating virtual experiments into a course, faculty should take the time to conduct thorough testing to ensure alignment with the course's medical humanities goals, including usability, accessibility, and inclusiveness. This will effectively integrate virtual experiments into medical ethics and empathy education, promoting the development of medical education towards a more humanistic approach.

4.2.3 Report

Reporting is an important part of virtual learning. Reporting after a virtual experiment is not only an important part of the entire learning process, but also a process for students to reflect deeply and learn humanistic care. It is also a good way to cultivate students' critical thinking. The purpose of medical humanities education is to allow students to experience humanistic care, ethical choices and communication skills in virtual situations, to exercise and cultivate students' critical thinking ability, to evaluate their own simulation situation exercises, and to feel and discover the communication rules between people. In addition, medical humanities education can also help students recognize their own shortcomings and find out the knowledge or skills they need to learn further in doctor-patient communication and their future careers. At the same time, it can also encourage students to continuously connect theoretical knowledge through reporting, so as to achieve a degree of integration, and on this basis, continuously strengthen their own reflective practice ability, and continuously improve their clinical empathy, sense of responsibility and effective communication skills [10].

Various virtual presentations, whether synchronous or asynchronous, whether completed individually or in groups, offer opportunities for achieving teaching objectives. A common approach is to have students reflect on a series of ethical choices, humanistic care strategies, and decision-making processes they have actually solved in a virtual setting. The design and planning of virtual experiments should also prioritize the choice of presentation method. Many virtual platforms automatically generate student performance data, and some even display students' decision-making paths and behavioral trajectories, helping them identify their strengths and weaknesses. Therefore, teachers can provide specific comments on students' performance on issues such as humanistic ethics based on their presentations, and strengthen targeted instruction on relevant areas when problems arise. This can also be combined with analytical evaluation to guide students' targeted reflection and improve their awareness of humanistic care.

Effective virtual debriefing should prioritize fostering students' expressive and collaborative skills. Open-ended questions and guided prompts should be used to encourage students to deeply consider the ethical and humanistic dilemmas inherent in the doctor-patient relationship. At the same time, an open, inclusive, and non-judgmental atmosphere should be maintained, fostering a safe environment for reflection and encouraging candid sharing and self-criticism. This series of design not only provides medical students with a valuable platform for cultivating their humanistic qualities but also lays a solid foundation for them to demonstrate humanistic care in their future clinical settings.

4.2.4 Evaluation

Evaluation is crucial for ensuring the effectiveness of virtual teaching, improving teaching quality, and safeguarding students' humanistic qualities. Evaluation is a systematic

review designed to analyze learning activities, students' learning experiences, and the humanistic nature of the teaching process to ensure the safety and effectiveness of virtual teaching in medical education.

The purpose of conducting virtual experiment evaluation is to: test whether the core value goals of medical humanities are achieved (ethical sensitivity, empathy, and communication skills); determine which virtual experiments are more conducive to promoting humanistic care; determine which virtual experiments are more effective and which links need improvement, and provide corresponding teaching suggestions; evaluate the suitability and effectiveness of the virtual resources used to provide a basis for future teaching course design and resource allocation; determine the optimal path to integrate medical humanities education into virtual experiments; collect relevant high-quality evaluation evidence and promote mutual experience sharing among teachers.

There are two primary evaluation methods for assessing the effectiveness of students' humanistic literacy development: formative and summative. Formative evaluation provides timely feedback on students' understanding and application of humanistic values during the teaching process. This approach helps students recognize flaws and shortcomings in their learning of humanistic values, enabling them to continuously correct and improve them in future studies. Summative evaluation assesses students' moral awareness, empathy, and other aspects of their learning at the end of the course. The combination of these two evaluation methods can fully reflect the role of virtual experiments in medical humanities education and provide reliable support for human development.

Formative assessment is a method for monitoring and evaluating the progress of students' and teachers' academic and competency development. By administering assessments and providing ongoing feedback during the teaching process, teachers can monitor students' progress in basic knowledge and humanistic literacy, allowing them to adjust instructional plans and measures in a timely manner, ultimately fostering further improvement. For example, students receive informal or low-scoring scores after completing each task. They are also required to write about their abilities to explain relevant medical humanities content, such as ethical understanding, communication skills, and empathy, in their own words, drawing on the context of the virtual reality training. They are also asked to spend a minute or two explaining how they can better understand the medical humanities and what challenges they encounter during their learning process. This approach is used to gauge students' understanding of these areas. By monitoring students' learning dynamics and responses in real time, personalized guidance and timely improvements can be provided to help them better integrate medical humanities concepts into virtual reality training.

Summative evaluations aim to comprehensively assess learning outcomes by comparing them with students' learning outcomes in areas such as humanities literacy, ethical cognition, and communication skills, and these outcomes are factored into students' final grades. In summative evaluations of virtual experiments, students must be informed in advance whether the scores or completion status of the virtual experiment will be included in their final grade, as well as the specific grading criteria. Students are typically required to conduct a simulation to ensure fairness and integrity of the evaluation. Furthermore, ample practice opportunities should be provided to familiarize students with the procedures and techniques of the virtual experiment, thereby ensuring the fairness and effectiveness of the evaluation.

Evaluation is an integral part of any learning activity, and this applies equally to virtual experiments. Evaluation design should be systematic and carefully considered. Questions should reflect the teacher's teaching objectives and students' learning priorities, and have measurable criteria. Teachers can use a variety of evaluation methods, such as questionnaires, performance assessments, and case studies, to assess student learning outcomes, choosing the method that best suits their teaching objectives and resource requirements. Making decisions based on evaluation results can help further optimize the design of virtual experiments, while also contributing to better students' medical and humanistic literacy and overall well-being.

## 5. Conclusion

In the context of integrating medical humanities education into virtual simulation experiments, strengthening the role of virtual simulation experiments in cultivating medical humanities literacy requires three key approaches: platform

development, technological innovation, and policy support. First, a comprehensive online communication platform should be established. Through interactive sessions such as real-time discussions, case analysis, and special seminars, students can gain a deeper understanding of core humanities content, such as doctor-patient communication, ethical decision-making, and patient care. Teachers can use this platform to track learning progress, answer questions promptly, and adjust teaching strategies, thereby improving educational effectiveness. Second, continuous technological innovation is needed to address key technologies in virtual simulation platforms, authentically presenting medical humanities scenarios, ethical conflicts, and communication situations, enhancing immersion and realism. Furthermore, innovative teaching tools should be developed using information technology, incorporating the latest medical humanities research findings into virtual scenarios to stimulate students' ethical thinking and humanistic care, thereby promoting innovative educational models that integrate medicine and the humanities. Furthermore, policy support should be strengthened, and incentives should be formulated to encourage universities to enrich the medical humanities elements in virtual simulation experiments, promote the development and sharing of teaching resources, promote high-quality courses, and expand the influence and popularity of virtual simulation in medical humanities education.

To ensure the sustainable development of medical humanities virtual simulation education, improved teacher training, resource sharing, and evaluation mechanisms are needed. On the one hand, systematic teacher training programs should be established to enhance teachers' ability to integrate medical humanities content into virtual simulation experiments. Training should cover virtual simulation technology application, curriculum design, and facilitation techniques. This training should help teachers use virtual scenarios to elicit ethical reflection and emotional resonance in students, thereby improving their teaching expertise. On the other hand, universities can reduce platform development and usage costs through license sharing mechanisms. By leveraging simulation models and technical support from external institutions, universities can reduce their own investment, rapidly deploy medical humanities virtual scenarios, and promote multi-university collaboration and curriculum dissemination. Furthermore, a scientific evaluation mechanism should be established to comprehensively measure the educational effectiveness of virtual simulation in terms of humanistic literacy, ethical judgment, and communication skills, comparing it with traditional teaching methods to ensure that it achieves the goal of enhancing doctor-patient relationships and ethical awareness. Furthermore, a sound support system should be established, with the necessary hardware and software resources allocated, and platform maintenance, data management, and teacher operation training strengthened. Leveraging national platforms, resources can be shared and developed to continuously optimize the application and practical quality of medical humanities virtual simulation education.

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