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Exploration of Innovative Teaching of Virtual Simulation of Nursing Anatomy Under the Background of "Three Teachings" Reform

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Abstract

Objective To explore the construction and effectiveness of the nursing anatomy smart course system based on the integration of teaching - learning - evaluation - revision. Methods A total of 303 nursing students in the fall of 2023 were randomly selected as the survey subjects. The students' autonomous learning ability and critical thinking ability before and after teaching were assessed, as well as the smart course learning situation after implementation , offline final theoretical scores, and teaching satisfaction. Results The browsing completion rate of teaching materials for 97 % of the students was 100% , and the total learning score of the digital human stem7.0 platform was (83.09 ± 5.48) points; the final theoretical examination score was (86.70 ± 6.87) points; after teaching, the scores of learning motivation, self-management, learning cooperation, and information literacy in the students' autonomous learning ability were higher than those before teaching, and the differences were statistically significant (P <0.05). After the teaching of the nursing anatomy course system based on the integration of teaching - learning - evaluation - revision, the students' scores of truth-seeking, open-mindedness, analytical ability, systematization ability, self-confidence in critical thinking, curiosity, and cognitive maturity were higher than before the teaching, and the differences were statistically significant (P <0.05). 97% of the students gave a high satisfaction rating. Conclusion The nursing anatomy smart course system based on the integration of teaching - learning - evaluation -revision effectively improves students' learning interest and participation in the nursing anatomy course, and promotes their autonomous learning ability and critical thinking ability. At the same time, students are also relatively satisfied with the exploration of the construction of the nursing anatomy course smart course system. Therefore, this study believes that the nursing anatomy smart course system based on the integration of teaching - learning - evaluation - revision has significant promotion value and can provide a useful reference for the teaching reform of smart anatomy.

Keywords

smart anatomy, smart course, nursing anatomy course, course system.

In recent years, the country has vigorously promoted the reform of smart teaching in nursing education, aiming to cultivate more talents with innovative spirit and practical ability. The "China Education Modernization 2035 " issued by the State Council in 2019 puts forward the guiding ideology, basic principles and main tasks for promoting education modernization. It is a programmatic document for the intelligent development of education (including nursing

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education) in China; the "Guiding Opinions on Further Promoting the Development of "Internet + Education " " issued in 2021 encourages colleges and universities to use information technology to improve teaching quality, and gradually leads the development of smart teaching in colleges[1] . As an important part of educational informatization, smart classrooms help to achieve the optimal allocation of teaching resources and efficient management of the teaching process. Looking back at the smart teaching of nursing anatomy in nursing education, after teaching practice and research verification, a series of smart course systems provide rich teaching resources through digital teaching platforms, including textbooks, maps, videos, cases, etc., so that students can learn anytime and anywhere, breaking away from the limitations of time and space, which helps to improve students' independent learning and accumulate professional[2] . In the past three years, our school has explored and formed a set of effective teaching - learning - evaluation - improvement integrated intelligent teaching system based on the digital human stem7.0 platform , which fully considers the individual differences of students and their online learning needs. However, the specific teaching effectiveness still needs to be further verified. To this end, this article will explore the teaching - learning - evaluation - improvement integrated intelligent teaching system based on the digital human stem7.0 platform.The construction and effectiveness of an integrated nursing anatomy intelligence curriculum system.

1. Exploration on the construction of nursing anatomy course system based on the integration of teaching - learning - evaluation - revision

1.1. The path of constructing a nursing anatomy curriculum system based on the integration of teaching - learning - evaluation - revision

1.1.1. Paradigm integration: a new path for online and offline intelligent teaching.

Traditional anatomy teaching models often focus on theoretical teaching, while modern educational technology provides more diversified teaching methods for nursing anatomy courses. In this context, the nursing anatomy course based on the integration of teaching - learning - evaluation - correction combines the traditional model with modern educational technologies such as VR and AR , forming a new teaching paradigm that complements each other online and offline.

1.1.2. Data aggregation: Building a rich new resource library for intelligent learning

In order to support this new teaching model, the nursing anatomy course first needs to build a rich teaching resource library. This includes collecting and organizing various teaching resources of the nursing anatomy course, such as classic textbooks, detailed atlases, high-definition videos, and actual cases, and compiling them into a systematic and comprehensive teaching database. At the same time, the nursing anatomy course will also use the digital human stem7.0 The platform collects students' learning data in real time, such as learning time, interaction frequency, test scores, etc., in order to conduct more in-depth data analysis and provide strong support for teaching optimization.

1.1.3. Attempt to carry out personalized intelligent review and correction

Based on the digital human stem7.0 platform, the nursing anatomy course that combines online and offline has taken shape. In the online part, students can use rich teaching resources for independent learning and testing, and the system will prompt teachers to review and correct their work in the first place; in the offline part, through practical operations, group discussions and face-to-face guidance from teachers, the knowledge learned can be further consolidated and deepened . Teachers will use the digital human stem7.0 platform to carry out the teaching of nursing anatomy. The data on the platform enables structured interpretation of the learning situation and carries out personalized teaching interventions in digitally empowered nursing,

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such as providing targeted tutoring materials, setting additional learning tasks , etc., to ensure that every student can get the teaching support that best suits him or her.

1.1.4. Applied representation: making abstract knowledge vivid and concrete

Nursing anatomy knowledge is often abstract and complex. This poses a considerable challenge to freshmen. In order to help students better understand and remember, the nursing anatomy course will make full use of multimedia technology, such as 3D models, animation demonstrations, etc., to present abstract anatomical structures in a concrete form. At the same time, through the teaching platform, the nursing anatomy course can also display students' learning outcomes, such as homework, test scores, discussion content, etc., which can not only stimulate students' enthusiasm for learning, but also cultivate their sense of competition and further promote the improvement of learning effects.

1.1.5.Digital intelligence integration: the bold integration of precise and intelligent teaching

With the continuous development of big data and artificial intelligence technology , digital human STEM7.0 The application of the platform in the field of teaching is also becoming more and more extensive. Nursing anatomy smart teaching will make full use of these advanced technologies to analyze and mine students' learning data. Through these precise data analyses, teachers can obtain more accurate teaching feedback and strategy suggestions, thereby continuously optimizing teaching content[4]. At the same time, the nursing anatomy course will also combine cutting-edge technologies and research results in the field of anatomy to continuously update and improve dynamic digital teaching resources.

1.2. The operation logic of the nursing anatomy course system based on the integration of teaching - learning - evaluation - revision

The above five parts together constitute the "teaching - learning - evaluation - revision " nursing anatomy curriculum system. They are interrelated and jointly support the construction of the curriculum system. From teaching methods (paradigm integration) to learning resources (data aggregation), then to personalized evaluation and correction (mixed intervention) and vivid presentation of knowledge (application representation), and finally to the integration of digital and intelligent technologies (digital and intelligent integration), forming a complete nursing anatomy course teaching cycle and a logical closed loop of curriculum system construction (see Figure 1).

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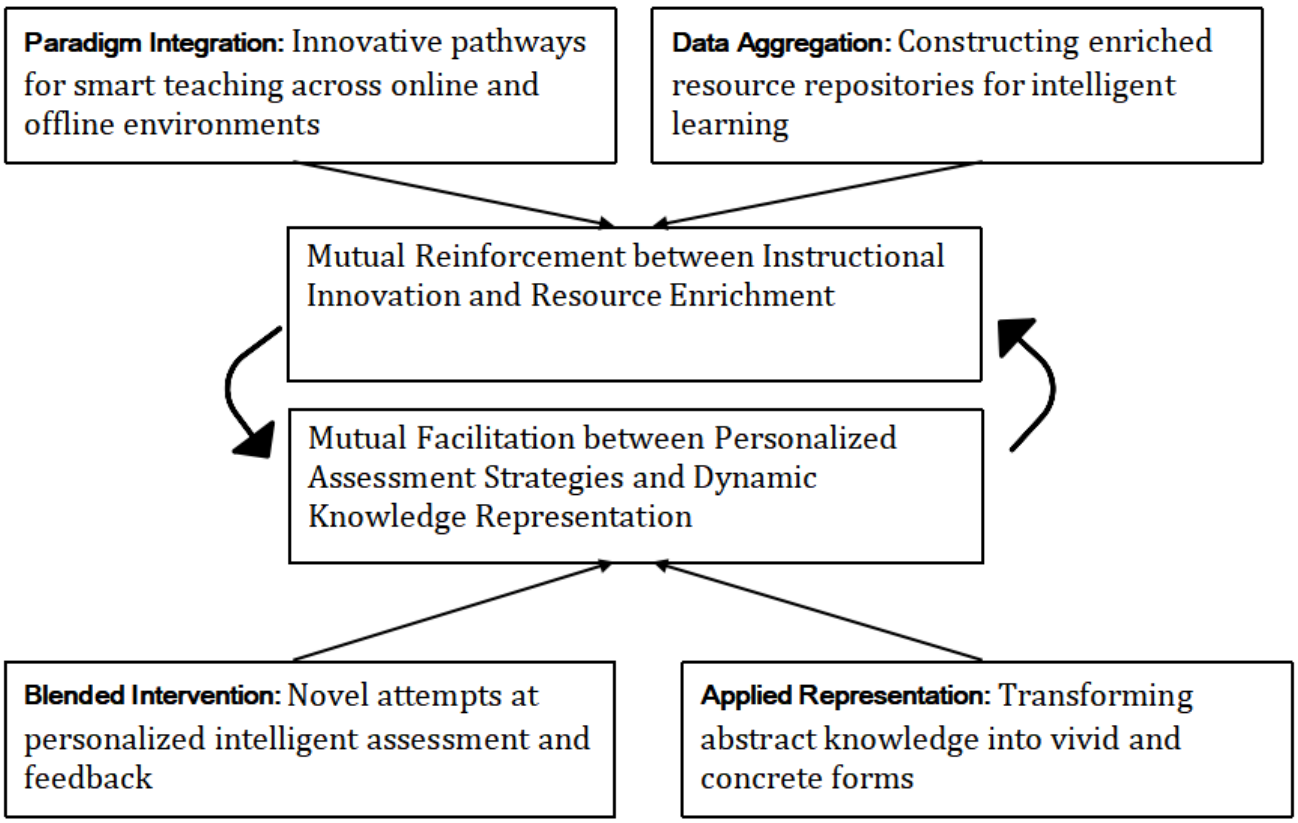

Figure 1: Exploration of the internal logic of the construction of nursing anatomy curriculum system based on the "triangle reform"

2. Materials and Methods

2.1. material

2.1.1. General data

175 students from the grade of 2021 and 128 students from the grade of 2022 of the higher vocational nursing major in our college in the fall class of 2023 were randomly selected as survey subjects.There was no difference in the students' admission scores, age, and gender composition.

(P >0.05). The syllabus and teaching hours are the same, and there are only differences in the teaching mode. The total teaching hours of this course are 70 hours, including 48 hours of theoretical classes and 22 hours of experimental classes .

2.1.2. Observation indicators

Before the course started, we distributed questionnaires to investigate students' autonomous learning ability and critical thinking.

After the course, the teacher will use Questionnaire Star to survey students' independent learning ability, critical thinking ability, and hybrid teaching evaluation. After the course, the teacher will assess students' theoretical knowledge and experimental operation . The final comprehensive score = theoretical test score * 60% + experimental operation score * 40% .

2.1.3. Statistical processing

SPSS25.0 Statistical analysis was performed using statistical software, and quantitative data were analyzed using

Mean ± standard deviation ($\bar{x} \pm s$) and count data were expressed as number of cases and

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percentage. The comparison before and after teaching was performed using t -test, and $P < 0.05$ was considered statistically significant.

2.2. Method

2.2.1. Pre-class preparation stage

(1) Resource integration and release: In the pre-class preparation stage, teachers need to carefully integrate the teaching resources of the nursing anatomy course, which includes detailed courseware, vivid videos, and clear diagrams. With the help of advanced digital teaching platforms, these valuable teaching resources can be quickly and widely released so that students can learn anytime and anywhere. In the preparation stage, teachers fully access AI artificial intelligence technology to accurately label teaching resources and scientifically classify them. (2) Pre-study task assignment: Teachers will use digital humans to stem7.0 The platform arranges specific pre-study tasks in advance and clearly points out the learning objectives and key points of each chapter. In this way, students can have a general understanding and expectation of the content to be learned before class.

After receiving the pre-study tasks, students can use the published teaching resources for in-depth independent learning. In the process, they record their questions and confusions to fully prepare for classroom learning, discussions and experiments .

2.2.2. Classroom teaching stage

(1) Interactive teaching: In the classroom teaching stage, teachers use digital human stem7.0, this advanced teaching platform comprehensively and deeply displays nursing anatomical knowledge in the form of multimedia. Through the presentation of pictures, texts, videos and audios, abstract and complex anatomical concepts become intuitive and easy to understand. In order to further enhance students' understanding and memory, real-time interactive sessions such as impromptu questions and group discussions are specially set up in the classroom. This not only effectively improves students' classroom participation, but also stimulates their enthusiasm for active thinking and communication , thereby consolidating and deepening their mastery of anatomical knowledge.

(2) Virtual reality practice: Innovatively introduced virtual digital human technology and virtual reality (VR) technology, and successfully built a virtual anatomy laboratory. In this virtual environment, students can perform anatomical simulation operations, so as to simulate repeatedly and deeply understand and remember the human body structure.

2.2.3. After-class consolidation stage

(1) Learning outcome assessment: During the after-class consolidation stage, teachers make full use of the digital human stem7.0 platform to publish targeted review materials and online test questions. Students can obtain professional growth points by taking photos and uploading their own anatomical works, thereby forming a smart resource library that is visible to classmates and can be evaluated by teachers. These online resources not only cover the theoretical content of nursing, but also include case analysis of actual application scenarios, aiming to deepen students' understanding and memory of knowledge points. By completing these online tests and sharing online, students can independently test their learning effects and timely discover and make up for their knowledge blind spots.

(2) Teaching improvement and optimization: Teachers will provide each student with personalized tutoring resources and learning suggestions based on their learning progress and online test scores. This teaching method of teaching students in accordance with their aptitude helps students to make special breakthroughs in their individual weaknesses. At the same time, when students encounter difficulties or doubts, they can ask questions or seek help from teachers at any time through the digital platform. Teachers will respond in a timely manner and provide detailed answers and guidance.

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2.2.4. Evaluation and feedback stage

(1) Learning outcomes evaluation: During the evaluation and feedback stage, teachers will regularly comprehensively evaluate students' anatomical learning outcomes. This evaluation not only focuses on the students' online participation, but also includes their test scores and practical operation ability. In order to analyze the students' learning status more scientifically , the labeled learning information of the Digital Human STEM7.0 platform is combined to deeply explore the learning data of students at each stage, and provide accurate and comprehensive teaching feedback for the specific progress of the anatomical experiment. (2) Teaching improvement and optimization: Based on the evaluation and feedback of students' learning outcomes, teachers will make targeted adjustments based on the Digital Human STEM7.0 platform. The platform's integrated teaching - learning - evaluation - revision solution optimizes teaching content in a timely manner based on differences in learning situations.

3. Result

3.1. Basic performance

3.1.1. Basic learning situation

Data from the digital human STEM 7.0 platform , which integrates teaching , learning , evaluation and revision , shows that most students are able to embrace the smart anatomy classroom, have a positive learning attitude, and show good integrated learning results. According to statistics from the course management backend, 100 % of students viewed course announcements and chapter information, showing a high level of attention. In the self-study of teaching materials such as videos and courseware, 97% of students completed browsing all resources, and the digital human STEM 7.0 platform has a high level of students who can read and understand the course information. The total learning score of the platform was (89.09 ± 5.48) , which showed that the students were devoted to and concerned about smart teaching. At the same time, the scores of task points, chapter tests and course discussions were (79.14 ± 4.21), (96.41 ± 6.18) and (17.63 ± 5.79) respectively . Combining all the scores , the average total score of students in the nursing anatomy smart course was (91.70 ± 3.32) , which showed the good results of the construction of the nursing anatomy smart course.

3.1.2. Final comprehensive score

The students' final comprehensive score was (86.70 ± 6.87) points, which further verified the solid results achieved by the students in their course learning.

3.1.3. Students' autonomous learning ability before and after teaching

After the teaching practice of the Nursing Anatomy Wisdom Course, the students ' autonomous learning ability in learning motivation, self-management, learning cooperation, and information literacy has been significantly improved. Compared with before teaching, the improvement in these aspects is statistically significant ($P < 0.05$), which fully demonstrates the positive role of the Nursing Anatomy Wisdom Course model in improving students' autonomous learning ability (see Table 1).

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Table 1 Comparison of students' autonomous learning ability scores before and after teaching ($\bar{x} \pm s$, points)

Dimensions	Before teaching	After teaching	t	P	
Learning Motivation	27.89±4.12	29.00±3.80	3.447		0.001
Self-management	37.36±4.23	39.49±4.90	5.002	<0.001	
Learning collaboration	16.54±3.05	17.76±2.27	5.586	<0.001	
Information Literacy	19.75±2.42	21.66±2.82	8.897	<0.001	
Self-learning ability	104.84±10.26	107.91±11.74	3.429		0.001

* $P < 0.05$ vs Control class

3.1.4. Comparison of critical thinking ability scores before and after teaching

After hybrid wisdom anatomy teaching, students' critical thinking ability has been significantly improved. Compared with before teaching, students showed higher levels in truth-seeking, open-mindedness, analytical ability, systematization ability, confidence in critical thinking, curiosity, and cognitive maturity, and these differences were statistically significant (P <0.05). This shows that hybrid wisdom anatomy teaching can improve students' critical thinking ability .

Anatomy teaching has a positive impact on students' thinking ability (see table 2) .

3.1.5. Student satisfaction evaluation

Students are also very satisfied with the hybrid intelligent anatomy teaching, exceeding 97% of students recognized the smart teaching method that combines online and offline teaching, which further proves the effectiveness and popularity of the newly constructed hybrid smart anatomy teaching (see Table 3).

Table 2 Comparison of students' critical thinking ability scores before and after teaching ($\bar{x} \pm s$, points)

Dimensions	Before teaching	After teaching	t	P
Seeking the Truth	31.96±4.85	33.79±5.71	4.601	<0.001
Open-minded	37.11±4.94	38.38±4.81	3.206	<0.001
Analytical skills	40.46±5.21	42.10±4. 13	4.294	<0.001
Systematization Capabilities	36.45±4.12	37.95±4.05	4.520	<0.001
Confidence in critical thinking	40.12±3.56	41.69±3.94	5.147	<0.001
Curiosity	40.85±4.82	42.83±4.61	5.168	<0.001
Cognitive maturity	35.89±6.24	37.36±6.98	2.733	<0.001
Critical thinking skills	267.14±22.24	274.08±23.78	3.710	<0.001

* $P < 0.05$ vs Control class

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Table 3 Satisfaction with online and offline hybrid teaching [n(%) , n=303]

project	Totally agree	Most agree	Basically agree	Disagree	Totally disagree
1. During the internalization and absorption stage, students can watch online learning platform videos and complete homework carefully.	72(23.8)	96(31.7)	117(38.6)	15(5.0)	3(1.0)
2. Watching videos and chapter tests can help you master Knowledge	76(25.1)	106(35.0)	104(34.3)	15(5%)	2(0.7)
3. Online learning platforms can help you monitor your learning progress	81(26.7)	94(31.0)	102(33.7)	21(6.9)	5(1.7)
4. Helps to improve learning interest	66(21.8)	78(25.7)	112(37.0)	42(13.9)	5(1.7)
5. Helps improve learning efficiency	67(22.1)	83(27.4)	114(37.6)	33(10.9)	6(2.0)
6. Helps improve the ability to obtain information	80(26.4)	90(29.7)	114(37.6)	16(5.3)	3(1.0)
7. Helps improve independent learning ability	77(25.4)	94(31.0)	112(37.0)	16(5.3)	4(1.3)
8. It is conducive to improving classroom enthusiasm and initiative	62(20.5)	84(27.7)	117(38.6)	35(11 .6)	5(1.7)
9. Online learning platforms are more effective for after-class review	85(28.1)	84(27.7)	119(39.3)	12(4.0)	3(1.0)
10. Are you satisfied with the Nursing Anatomy Wisdom course?	116(38.3)	87(28.7)	89(29.4%)	9(3.0%)	2(0.7%)

4. Discussion

4.1. Discussion on the effectiveness of the nursing anatomy course system based on the integration of teaching - learning - evaluation - revision

Through teaching practice and data analysis, the nursing anatomy course system based on the integration of teaching - learning - evaluation - revision has achieved remarkable results. The final comprehensive score of the surveyed students was (86.70 ± 6.87). This shows that this model integrates online and offline teaching resources, uses the digital human stem7.0 platform digital teaching platform, AI technology,

The integration of virtual reality technology provides a rich variety of learning paths and interactive methods for nursing anatomy teaching , improves students' learning interest and participation, and effectively promotes students' autonomous learning ability and critical thinking ability in nursing anatomy[5].

Judging from the results of the learning outcome assessment, students have achieved excellent results in video learning, task completion, chapter testing, and course discussion, and the average total score has reached a high level. After the implementation of nursing anatomy smart teaching, students' critical thinking ability has been significantly improved, further verifying the effectiveness of this model.

4.2. Suggestion

4.2.1. Improve teachers' smart education technology level

With the continuous development and application of smart education technology, teachers need to constantly update their knowledge and skills to adapt to new teaching needs. It is recommended to strengthen teacher training, improve teachers' application capabilities in

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smart education technologies such as digital interactive microscope systems, integrated signal acquisition and processing, human digital imaging and models, and further innovate and promote smart teaching resources for nursing[6-7].

4.2.2. performance in the whole process of smart teaching

Students' digital learning level is one of the key indicators of the success of smart teaching. Teachers should pay close attention to students' academic performance in the whole process of nursing anatomy smart teaching , timely understand students' needs and confusions in online learning, and provide information about digital human stem7.0. Personalized guidance and support for the use of the platform system and its equipment help students solve problems in digital learning of nursing anatomy in a timely manner. At the same time, combined with digital human STEM7.0 Big data monitoring of platforms , etc., strengthen the analysis and mining of students' learning data, and provide accurate teaching suggestions for anatomical experiments and the application of anatomical resources[8] .

4.2.3. Continuously optimize the smart teaching model

With the iterative update of smart education equipment and the development of medical education , the smart teaching model of nursing anatomy courses also needs to be continuously adjusted and optimized. It is recommended that teachers continuously update and improve the production of digital teaching courseware for human anatomy based on students' learning needs and feedback, combined with cutting-edge technologies and research results in the medical field, to ensure the close integration of teaching and medical development. At the same time, compared with the current teaching software, specimens on digital platforms, physical specimens, etc., the collection, editing and application of clinical digital data in anatomy need to be continuously connected to more diversified smart teaching platforms to inject new vitality and motivation into nursing anatomy[9].

Fund project

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