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A Practical Study on Inquiry-Based Teaching in Higher Vocational Basic Nursing Courses from the Perspective of Cultivating Innovative Literacy

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Abstract: Innovative literacy refers to the process in which individuals with novel thinking and abilities improve and upgrade existing things. It reflects the new standards and expectations put forward by higher vocational basic nursing for young students in order to meet the needs of future society [1]. The current curriculum standards of higher vocational basic nursing not only put forward the goal of cultivating students' core literacy, but also emphasize the adoption of diversified teaching strategies to stimulate students' cooperation and exploration. Based on existing research literature, this study adopts research methods such as action research, questionnaire survey, and interview, and verifies the effectiveness of inquiry-based teaching in cultivating innovative literacy through scale data analysis. The results show that the inquiry-based teaching and related practice processes designed in the study can promote the cultivation of students' innovative literacy.

Keywords: Innovative literacy; Inquiry-based teaching; Action research

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1. Introduction

In the context of the coordinated development of the "Healthy China" strategy and digital medical care, nursing education is facing a dual revolutionary proposition: it must not only respond to the demand for precise care triggered by population aging, but also adapt to the medical service ecology reshaped by artificial intelligence [2]. The structural lack of innovative literacy exposed in current higher vocational nursing education — 82.3% of nursing students in clinical practice have a competency gap of "being proficient in technical operations but unable to deal with atypical cases" (according to the 2023 Blue Book on the Quality of Nursing Education in China) — highlights the profound contradiction between the traditional skill-teaching model and the demand for innovative talents in medical care. By constructing a "three-dimensional spiral" inquiry-based teaching system through innovation, it guides students to develop an "evidence-based decision-making clinical thinking mode"; forges nursing creativity driven by the "empathy-innovation" dual axis [3]; at the same time, aiming at the common problems of higher vocational nursing students such as weak innovative thinking and lagging practical ability, it transforms basic theories and operation standards in an inquiry-based way and builds a step-by-step training path.

2. Objects and methods

2.1. Research objects

Using the cluster sampling method, 55 full-time nursing students from a class of the 2021 cohort in our college were randomly selected for the practical teaching research from February 2022 to June 2022. Their ages ranged from 18 to 21, with an average age of (19.04 ± 0.27) years. There were no significant differences in general conditions such as age, previous academic performance, and teaching teachers among the students ($P > 0.05$).

2.2. Research methods

2.2.1. Teaching methods

Based on the talent training program, curriculum standards, curriculum objectives, and the key and difficult points of operational skills teaching, it was determined that the basic nursing practical training course for this semester would consist of 36 class hours, covering 12 projects and 15 tasks, including: making unoccupied beds, making occupied beds, making anesthetic beds, aseptic techniques, isolation techniques, oral care, nasal feeding, catheterization, measurement of vital signs, various injection methods, preparation of penicillin skin test solution, intravenous infusion, intravenous blood transfusion, oxygen inhalation, etc. The operational items involved in the teaching process include intramuscular injection, catheterization, etc. This study adopted the theoretical framework of action research, and each research cycle included four stages: planning, implementation, evaluation, and feedback adjustment. Through the spiral ascending mechanism of "planning-action-review-evolution", the research quality was improved step by step. Each cycle focused on different development goals: the first cycle focused on the original innovation of the practical framework, the second cycle focused on the dynamic adjustment of the operation mechanism, and the final cycle focused on the systematic condensation of research results, forming a complete cognitive iteration closed loop[4]. Next, the action research will be carried out with the example of gluteus maximus intramuscular injection in basic nursing.

2.2.2. Teaching process

First round of teaching practice research

Pre-class preparation stage

Teachers pushed micro-class videos of intramuscular injection, operation guidelines, and preview task lists through the teaching platform, and monitored the learning progress using the Learning Pass software (the preview completion rate was 92%). Students completed fragmented learning through mobile terminals, and the platform automatically generated personalized diagnostic reports, marking weak points of knowledge.

In-class teaching implementation

(1) Situation Introduction: Introduced with an emergency department motorcycle accident case, and displayed the patient's signs (T39.2℃, purulent secretions) through 3D animation, guiding students to analyze the selection of injection sites and the prevention of complications.

(2) Integration of Theory and Practice: Combined with AR anatomical models to dynamically demonstrate the positioning methods of gluteus maximus injection (cross method, line connection method), and used virtual simulation systems to real-time evaluate the accuracy of students' operations.

(3) Cultivation of Higher-order Thinking: Debated on "safe injection for tremor patients", and students put forward optimization schemes based on comprehensive knowledge of anatomy and pharmacology[5].

After-class expansion and evaluation

Assigned homework from the cloud case database to compare the key points of injection for patients with different body types; set up an innovative project of "intelligent injection device design". Adopted four-dimensional dynamic evaluation (operation standardization 40%, case decision-making 30%, innovation proposal 20%, participation 10%), and

established a wrong-question gene database.

Second round of teaching practice research

On the basis of the first round, two optimizations were made: (1) Teaching Atmosphere: Strengthened the open inquiry situation; (2) Teaching Links: Adopted step-by-step progressive teaching: theoretical explanation: systematically explained the anatomical differences in gluteus maximus positioning; operation demonstration: dynamically demonstrated the standard process through hip models; group practice: all students conducted repeated simulation training; personalized feedback: teachers corrected operation details in a targeted manner. Realized the "theory-practice-feedback" closed loop, and improved the standardization of clinical operations.

Third round of teaching practice research

Focused on the in-depth application of virtual simulation technology: (1) Pre-class: Pushed micro-class videos, and conducted online supervision to ensure preview; (2) In-class: Case introduction: emergency injection needs of patients with open fractures; virtual training: visualized injection sites through the simulation system to solve the problem of operational timidity; (3) After-class: Assigned thinking questions on pain management, and the platform collected learning questions. Technology empowerment significantly improved the accuracy of positioning and operational confidence.

3. Teaching evaluation

3.1. Teacher evaluation

Students' scores are obtained by completing the preview tasks assigned by teachers on the platform before class, with a full score of 100. For each uncompleted task, 10 points will be deducted. Students' scores for mastering operational skills through virtual simulation technology, such as virtual simulation training technology for catheterization, virtual simulation training technology for nasal feeding, virtual simulation training technology for gluteus maximus intramuscular injection, etc., with a full score of 100. For each uncompleted task, 10 points will be deducted. Scores are also given based on the number of interactions with teachers in class; the more interactions, the higher the score. This part of the score is given by teachers according to the actual situation of students. The final exam includes the assessment of operational skills, with both objective and subjective questions, focusing on examining students' understanding, mastery and application of nursing professional knowledge, with a full score of 100[6].

3.2. Evaluation with the innovation literacy ability scale for higher vocational nursing students

The Innovation Literacy Ability Scale for Higher Vocational Nursing Students was distributed before and after the course for investigation. A total of 55 questionnaires were distributed, and 55 valid questionnaires were recovered, with an effective recovery rate of 100%. The scale includes 4 dimensions: innovative thinking, innovative ability, innovative methods and innovative practice. Each dimension involves several items, totaling 20 items. Each item adopts a 5-level scoring method, with 5 options: completely inconsistent, relatively inconsistent, average, relatively consistent and completely consistent, which are scored 1 - 5 points respectively. The minimum score is 20, and the maximum score is 100. A higher score indicates stronger innovation literacy ability[7].

4. Statistical methods

In this study, questionnaires were distributed through Wenjuanxing (a Chinese online questionnaire platform) to collect survey data in real time. SPSS 26.0 software was used for descriptive statistics and statistical analysis.

5. Results

Results of questionnaire data

Through three rounds of action research on inquiry-based teaching, the students' performance distribution is as follows:

They completed 15 pre-class preview tasks, with scores ranging from 82 to 93, and an average score of (83.50±3.41). They completed 33 in-class interactions (in-class exercises), with scores ranging from 79 to 100, and an average score of (85.61±3.11).

They completed 19 virtual simulation training sessions, with scores ranging from 75 to 95, and an average score of (86.33±4.56). They completed 15 phased tests, with scores ranging from 81 to 95, and an average score of (86.22±4.02). The final exam scores ranged from 70 to 96, with an average score of (87.64±2.67). The distribution of students' scores is shown in **Table 1**.

Table 1. Distribution of Students' Scores in Various Parts [n (%)]

EvaluationItem	Excellent(90-100)	Good(80-90)	Moderate(70-80)	Poor(60-70)
Pre-class preview tasks	29 (53)	22 (40)	4 (7)	0 (0)
In-class interactions	21 (38)	19 (35)	10 (18)	5 (9)
Virtual simulation training	19 (35)	27 (49)	9 (16)	0 (0)
Phased tests	25 (45)	23 (42)	7 (13)	0 (0)
Final comprehensive scores	30 (55)	24 (44)	1 (1)	0 (0)

Evaluation of the innovation literacy assessment scale for higher vocational nursing students

A self-designed Innovation Literacy Assessment Scale for Higher Vocational Nursing Students was distributed, with 55 questionnaires issued and 55 valid ones recovered, resulting in an effective recovery rate of 100%. The scale includes 4 dimensions: innovative thinking, innovative ability, innovative methods, and innovative practice, each involving several items. The scores of each dimension in the students' innovation literacy assessment scale are shown in **Table 2**.

Table 2. Scores of the Students' Innovation Literacy Assessment Scale

Dimension	NumberofItems	Scores(x±s)
Innovative thinking	4	16.23±3.11
Innovative ability	6	20.54±2.87
Innovative methods	5	21.67±1.47
Innovative practice	5	19.65±3.35

6. Discussion

6.1. Implementing inquiry-based teaching in higher vocational basic nursing courses from the perspective of innovative literacy helps improve students' learning effects and ensure teaching quality

The in-depth empowerment of virtual simulation technology by the technical support system. During the preliminary learning process, students completed 19 virtual simulation training sessions, with scores ranging from 75 to 95, and an average score of (86.33 ± 4.56). This achievement is attributed to the extensive application of innovative technologies. With the rapid development of innovative technologies, by using virtual simulation training technology and constructing dynamic anatomical models through VR, students can perceive the needle insertion depth and resistance changes of

intramuscular injection through haptic feedback devices, thereby improving the accuracy of operations [8]. The decomposed demonstration of body surface positioning for gluteus maximus injection, combined with animation annotations of the division of the line connecting the anterior superior iliac spine and the ischial tuberosity, helps students overcome spatial imagination obstacles, making it easier for them to master details such as the site, method, and needle insertion angle of intramuscular injection. Students have a more intuitive understanding of practical technical operations, which greatly improves learning effects. At the same time, it makes students more directly feel the power of technological innovation, thereby stimulating their innovative thinking and awareness to discover more points worthy of innovation and creation [9]. Therefore, the inquiry-based action research teaching in higher vocational basic nursing courses, through the three-dimensional linkage mechanism of refined teaching design, in-depth technical empowerment, and full-cycle quality monitoring, not only realizes the transformation from knowledge transmission to ability generation but also constructs a talent training closed loop that highly matches clinical needs [10].

6.2. Implementing inquiry-based teaching in higher vocational basic nursing courses helps improve students' innovative literacy and ability, develop innovative thinking, break through innovative methods, and promote innovative practice

In higher vocational basic nursing courses, the inquiry-based teaching model with innovative literacy as the core presents multi-dimensional training characteristics [11]. The research found that this model plays a positive role in promoting the overall development of students' innovative ability, but the effect varies in different dimensions.

Significant progress in thinking and ability: Through the problem-driven inquiry-based learning framework, students gradually showed stronger critical thinking and creative problem-solving abilities in clinical case analysis [12]. The collaborative tasks and reflection links designed in the teaching process effectively stimulated students' systematic innovation awareness, making their thinking mode shift from passive acceptance to active exploration. Gradual characteristics of practice transformation: Although the improvement of initial practice results was relatively limited, with the advancement of the teaching cycle, students' performance in operational standardization and clinical response strategies showed a steady optimization trend [13]. Especially in open situational teaching, students gradually overcame the separation between theoretical knowledge and practical application. With the assistance of teaching scaffolds, the quality and efficiency of practical innovation have been observably improved [14].

Overall, this teaching model forms a training closed loop through structured design, enabling students' innovative literacy to develop systematically. In the future, we can further promote the coordinated development of innovative abilities in different dimensions by increasing the proportion of real clinical scenarios and optimizing the connection mechanism of reflective practice links.

7. Research summary

As a key carrier for implementing the fundamental task of fostering virtue through education, innovative literacy has become an important starting point for deepening the connotative development of vocational education. Based on the characteristics of nursing professional education, this research has constructed a three-dimensional training system of "literacy cultivation- curriculum innovation- practice transformation". By systematically deconstructing the growth law of higher vocational nursing talents, innovative elements are deeply integrated into the whole-cycle teaching of basic nursing courses. This teaching innovation has significantly activated the potential of nursing learners: in clinical probation, students have shown stronger learning motivation and more flexible clinical adaptability; in team collaboration, they can creatively integrate interdisciplinary knowledge to propose nursing plans. Educational practice shows that when the cultivation of innovative literacy and professional education form a deep coupling, it can not only improve teaching efficiency, but also inject endogenous power for the sustainable development of nursing talent training [15].

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