



Design and Implementation Strategies of Nursing Education Practical Training Curriculum Based on the World Vocational College Skills Competition

Chan Tang¹ and Xin Zhang^{2,*}

¹ Chengdu Polytechnic, Chengdu, Sichuan, 610000, China

² Sichuan Dianzhi Technology Co., Ltd., Chengdu, Sichuan, 610000, China

SUMMARY: *The study designs an online educational assistance model based on label distribution using machine learning methods with respect to nursing education practical training courses, through steps such as K-fold basis function determination and CACNN structure design. On this basis, the teaching content, teaching context, and teaching evaluation were comprehensively optimized to promote nursing students' rapid learning. The fifty nursing students in this study were randomly chosen from Y vocational medical school. The evaluation of their nursing skills, theoretical scores, and other related factors was conducted through independent samples test procedure without considering sample division. This test procedure was carried out in order to observe the feasibility of the nursing education practicum course design strategy suggested in this study and its potential effect on participants. Using the proposed nursing education practicum course design strategy, the participants of the experimental group had much higher average scores compared to those of the control group. Scores obtained by the experimental group students ranged from 81.68 to 89.12. The practical training skill score difference between the two groups reached 5.64 to 9.12 points in favor of the former group. Furthermore, improvements in critical thinking skills and overall self-efficacy among participants of the experimental group have been recorded. Nursing students recognized the curriculum design strategy of this paper highly, with a comprehensive score of more than 4.*

KEYWORDS: *machine learning; educational assistance model; independent testing; curriculum design; practical training in nursing education*

1 Introduction

The launch of the "Healthy China 2030" initiative has made the development of practically skilled nursing professionals an increasingly pressing priority [1]. At present, nursing education in vocational colleges and universities is facing problems such as the development direction is not equal to the demand of the industry, and the quality of talent cultivation is not closely connected with the requirements of clinical jobs, which requires vocational colleges and universities to actively reform [2-4]. In accordance with the guiding principles of the World Vocational College Skills Competition, the establishment of a practicum curriculum that can produce competent, all-rounded, and industry-focused nurses is an important approach through which vocational schools can achieve curriculum reforms [5, 6].

Being the number one event in the vocational education sector of China, the World

*dz_zhangxin@163.com

<https://doi.org/10.65102/is2026407>

Vocational College Skills Competition not only carries the mission of strengthening comprehensive education and is committed to improving students' professional skills and comprehensive quality, but also shoulders the task of improving the scientific nature of the event's implementation, in order to closely match the actual needs of the country's industrial development [7-10]. For vocational colleges, the World Vocational College Skills Competition has proven to be an ideal way of promoting nursing programs in many aspects, including setting up professional training objectives, creating course curricula, improving education methods, training educators, and establishing practice bases [11-13]. In essence, the competition prompts nursing programs at vocational colleges to look into industry trends and demand to guide their training process. It is not only about learning nursing theory, but the ability to apply the theoretical knowledge flexibly in practice, which will lay the groundwork for nurturing nurses who are competent professionals with high moral integrity [14-17]. In more practical terms, instructors need to adopt different methods of instruction to ensure that the basic nursing theory knowledge is solidified in students [18-20]. Meanwhile, vocational colleges ought to emphasize the need for practical skills by allowing students to participate in competition-related projects to help them master core nursing skills [21-23]. In addition, the institutions are supposed to encourage innovation in their students by allowing them to conduct entrepreneurship projects and others so that they can gain more perspectives and learn how to solve practical problems in nursing practice [24, 25].

In order to boost the achievements of nursing students in the World Vocational College Skills Competition, the development of an educational assistance model using the methods of basis function determination, CACNN model structure design, and labeling approximation distribution is done. Based on this background, a dual mode of nursing education practicum course design was developed and applied in the Y vocational medical college. By utilizing the dual modes of learning in this project, students will be able to experience clinical nursing practices more directly. In addition, a quasi-experimental design using the method of pre-test and post-test for both experiment and control groups and also independent samples testing is also adopted in this project.

2 Research on the design and implementation strategy of practical training courses in nursing education

2.1 Machine learning based online education assistance model building

In order to make the interactions between the students and the model more effective, Labeling Distribution Based Model for Online Education Assistance (LGBCAN) is proposed. The process of implementing the LGBCAN includes two phases which involve the use of boosting trees and convolutional neural networks.

2.1.1 K-fold layer basis function determination

LightGBM is an ensemble method that combines weak learners in one model to create a strong learner. In this research, the LightGBM acts as the basis function. By using K-fold cross-validation, the risk of overfitting is minimized, allowing for better performance of the model in learning from the new data. For that reason, an adaptive loss function has been added to the LightGBM to facilitate the learning of the minor classes and produce accurate results. When predicting a function relationship in sequence in time, the loss function is given by Eq:

$$L = \sum_i l(\hat{y}_i, y_i) \quad (1)$$

where the prediction result of one branch of the decision tree in the i st sample, the actual result of one branch of the decision tree in the i nd sample, and the loss function of one branch of the decision tree are each calculated separately.

At the same time, L1 regularization is used in order to create a sparse node structure, which would help reduce the complexity of the model and thereby avoid overfitting. The updated loss function for the model is:

$$a_i = \text{floor}\left(\frac{C}{n_j}\right) \quad (2)$$

$$L = \sum_i a_i \times l(\hat{y}_i, y_i) + \tau \|\omega\| \quad (3)$$

L1 regularization coefficients are estimated using Bayesian optimization, which is more resistant to local minima than random search techniques used traditionally to find adequate L1 regularization coefficients.

2.1.2 Multi-layer CACNN structure design

A shallow 1D CACNN model was used to retrain the model using the prediction results of the LightGBM model as input values. This helped increase the generalization performance of the model without causing too many additional costs to the model in terms of time and memory usage.

In addition, the same loss function strategy used in the LightGBM section was also implemented in the CACNN model in order to further enhance the performance of the prediction.

Five different predictions made by the LightGBM model using the K-fold validation technique were used as the input value when training the CAN model. However, not all predictions performed well when put into the CAN model. As a result, the CA strategy used in the SENet model was brought into LightGBM in order to help improve the training efficiency of LightGBM. In the attention module, the Squeeze operation compresses all the information present in the feature matrix Z into one single value using the information inter-connection between channels in order to improve computational accuracy on a larger scale. The formula of Squeeze is as follows:

$$F_s(Z_c) = \frac{1}{W \times H} \sum_{i=1}^W \sum_{j=1}^H Z_c(i, j) \quad (4)$$

where W and H represent the width and height of the feature map respectively. The excitation module takes the output feature from the input module and runs it through two fully connected modules. The first fully connected layer converts the C channel output feature into C/r channel output feature, thus minimizing the computational complexity of the algorithm. The second fully connected layer brings back the number of channels to C . r stands for compression ratio here.

2.1.3 Approximate distribution of model labels

Convolutional Neural Network (CNN) is an outstanding model in the field of deep learning with a wide range of applications. The research proposed LGBCAN consists of two convolutional layers, CNN and channel attention (CA). The CA of the optimized SENet model learning results is then introduced into the CNN to enhance the training results of LightGBM using channel attention network (CAN). The generalization ability of the model is improved without increasing the time cost and memory. The specific structure of the LGBCAN model is obtained as shown in Fig. 1.

Note that the mechanism strengthens the salient features and suppresses the irrelevant features by methods such as weight analysis. Five separate prediction outcomes of LightGBM are obtained from the K-fold cross-validation method and used as input variables for the CAN model. Variables which demonstrate better regression performance will be weighted accordingly to improve the prediction ability of the model on student performance. In contrast, the irrelevant variables will have smaller weights since they contribute less to achieving the desired outputs.

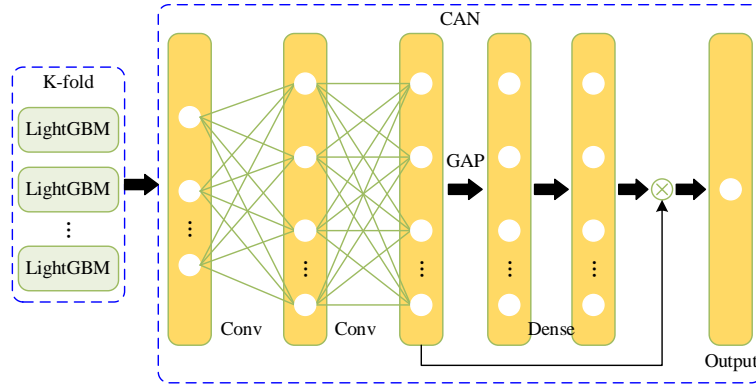


Figure 1: LGBCAN model structure

In the online education model based on label approximation distribution presented in this paper, regression analysis will be performed to get the output y_{out} of the model within the interval $[0,1]$. Then, the measured output y_{out} will be evaluated according to the categorization threshold TT , while its corresponding predicted categories will depend on the threshold intervals. Hence, given a certain LightGBM model y_p with N categories in total, the following categories can be expressed by:

$$y_p = \begin{cases} 0, & y_{out} \leq 1/N \\ \dots & \\ N, & y_{out} \leq 1 \end{cases} \quad (5)$$

with the total number of samples in the dataset being represented in this manner, and y_{out} indicating the probability of the class of each sample. The above method of setting thresholds works very well when the sample sizes within each class of the model are approximately the same. But where the samples are highly imbalanced, the model tends to generate significant bias in computing the predicted classes, resulting in low recall, and hence not enough learning for the minority classes. To mitigate the above challenge, we recommend using an adaptive approach in approximating the label distribution such that:

$$y_p = \begin{cases} 0, & y_{out} \leq C_0/C \\ \dots & \\ N, & y_{out} \leq \sum_{n=0}^N C_n/C \end{cases} \quad (6)$$

where $\{C_0, C_1, \dots, C_N\}$ is the number of samples in the $\{0, 1, \dots, N\}$ class. As shown from the above formula, the thresholds for each class are automatically adjusted based on their sample sizes, thereby facilitating better learning for the minority classes.

2.2 Design of practical training courses in nursing education

Curriculum design is a systematic design program that can scientifically arrange the various elements of teaching and learning according to the teaching content and requirements as well as the characteristics of nursing students to determine a timely teaching program. The study takes the intelligent classroom as the medium, carries the online learning assistance model designed above, and proposes a new type of nursing education practical training course design strategy based on the implementation of three-dimensional teaching objectives. According to the characteristics of online and offline teaching, the traditional teaching design ideas and concepts are abandoned, and a new rational design is adapted to the combination of virtual and real nursing education practical training course information technology teaching mode.

2.2.1 Teaching objectives

The first dimensional goal: the goal of knowledge and skills of professional courses, nursing students can complete this goal through the professional knowledge points of literacy, understanding and practical application of knowledge and skills.

The second dimensional goal: the process and method of learning and applying professional knowledge and skills of nursing students, in the process of learning and applying to cultivate nursing students' ability to find problems, solve problems and independently learn to apply knowledge and skills, the realization of this goal needs to be completed through the task-driven guidance to collect information, practical application, evaluation of the effect of the analysis of the problem, and innovative expansion of the learning process.

The third dimension goal: professional attitude, emotion, value goal, is to cultivate nursing students correct professional attitude, professional concepts and other comprehensive professional literacy goals, this goal can be set through the scenario, case study to guide the nursing students to the profession of professional emotional experience to complete.

The design of the objectives of nursing education practical training courses closely focuses on the above three dimensions, and integrates the knowledge objectives, skill objectives and emotional objectives into the whole teaching process.

2.2.2 Teaching context

The research unfolds the design of the teaching context in addition to the allocation of role characters, but also includes teaching facilities, practical training bases and other hardware facilities and the teaching process of the teacher's theoretical level, skill level, teaching experience and teaching skills and other soft facilities. When designing the teaching environment in the teaching experiment, in addition to the multimedia classroom with modern information technology and simulation simulation wards, the training classroom is also equipped with the same medical equipment and devices as the clinical ward as well as high-

fidelity simulation patients, training modules, standardized patients, etc., which provides a strong environmental facility guarantee for the experimental teaching.

2.2.3 Evaluation of teaching and learning

Course teaching evaluation is one of the important steps in course teaching, one of the important methods to achieve the course teaching objectives, and an important criterion to test the teaching effectiveness of teachers and students. The study incorporates online learning hours, online learning results, classroom participation, group cooperation, and completion of project reports of practical training courses into the scope of assessment, and finally combines the results of operational and theoretical assessment to generate comprehensive grades.

2.3 Implementation of practical training programs in nursing education

2.3.1 Research program

(1) Research Methods

Quasi-class experimental design is the most commonly used method in educational experimental design for situations in which an experimental design cannot be used to control irrelevant variables and randomization cannot be used to assign experimental subjects in an educational situation. This study belongs to the quasi-class experimental design, and adopts the experimental group, control group pre and post-test design.

(2) Subjects of the study

Nursing students of the nursing program in the class of 2024 in Y vocational medical school in a province, 50 people. Inclusion criteria:

- a. Nursing students majoring in nursing direction in Y vocational medical college.
- b. Informed consent and voluntary participation in the study.
- c. No psychiatric disorders.

The subjects who voluntarily participated in the study were divided into 2 groups using lottery method:

- a. Experimental group: nursing students majoring in nursing orientation in the class of 2024, totaling 25.
- b. Control group: nursing students specialized in nursing direction in the class of 2024, a total of 25 people.

(3) Place of study

Y vocational medical school, there are four faculties, such as nursing school, medical technology school, health management school and humanities and social sciences, among them, the nursing school began to recruit nursing students specialized in nursing direction since 2010, and the number of enrollment is increasing every year.

2.3.2 Research tools

The tools adopted in the present research included two questionnaires, namely, the pre-test questionnaire and the post-test questionnaire. The pre-test questionnaire consisted of two sections: a section on basic information and a self-assessment of students' core competencies in the field of nursing. On the other hand, the post-test questionnaire included a self-assessment of students' core competencies in nursing and a course evaluation form.

(1) Reliability and Validity Measurement of the Self-Assessment Scale for Nursing Students' Critical Thinking Ability

The self-assessment test concerning nursing students' critical thinking ability adopted in this study was modified based on literature review. In specific, the test is particularly suitable for students of vocational colleges. The test includes 2 parts:

a. General information questionnaire, including age, gender, ethnicity, religion, grade level, perception of nursing core competencies, and grade point average of compulsory courses in the previous semester.

b. The critical thinking skills self-assessment questionnaire is made up of 7 dimensions and 34 items which include the following: seeking of truth, open-mindedness, critical analysis skills, systematic thought, confidence in reasoning, intellectual curiosity, and cognitive maturity. 5-point Likert scales were used with ratings ranging between 1 and 5 as "not capable at all" to "very capable."

The reliability test was performed using a pre-test conducted among 50 nursing students where it was found that all the CVIs of the dimensions fell between 0.975 and 1. The Cronbach's α coefficient of the whole scale came to be 0.983 whereas that of the individual dimensions varied between 0.905 and 0.954.

(2) Reliability and validity of general self-efficacy scale

The scale of general self-efficacy was created based on the pre-existing models. In addition to the general information survey, the most important general self-efficacy self-assessment questionnaire consisted of 4 dimensions and 17 entries, which were confidence in learning ability, confidence in learning behaviors, efficacy in problem solving, and stability in emotional state, and the same Likert 5-point scale was used for the assignment of scores. The CVI values of each dimension ranged from 0.961 to 1. The Cronbach's α coefficient of the total scale was 0.977, and the Cronbach's α coefficients of each dimension ranged from 0.894 to 0.947.

(3) Nursing Education Practical Training Program Evaluation Scale

Self-designed course feedback questionnaire consisting of 30 entries in five characterizing dimensions: goals and information, support, problem solving, feedback, simulation realism, and one open-ended question. Assign values of 1, 2, 3, 4, and 5 respectively to "strongly disagree", "relatively disagree", "agree", "relatively agree", and "strongly agree". It is mainly used to understand the overall evaluation of the course by nursing students, covering course organization, number of credit hours, course content, teaching methods, evaluation methods, faculty level, and course teaching conditions.

2.3.3 Curriculum implementation

(1) Implementation steps

a. The leaders of the School of Nursing of Y Vocational Medical College were consulted before the beginning of the study and consent was obtained.

b. Pre-test procedures included administering a general information questionnaire and nursing core competency self-assessment form to all study participants. Subsequently, study participants were randomly assigned to the experimental and control groups via a drawing technique.

c. The experimental group was provided with training according to the nursing education practicum course design model based on the three-dimensional objectives for teaching discussed above. In contrast, the control group was provided with training based on the traditional nursing classroom course teaching approach. Both groups utilized identical selected cases during the course. Training for both groups began in late April 2025 and ended in late June 2025. The training lasted a total of 32 credit hours, including 28 credit hours for lecture sessions and four credit hours for evaluation.

d. After completing the course, nursing students in both groups were assessed again using the nursing core competency self-assessment form. Moreover, the experimental group was also asked to submit a course feedback questionnaire for course evaluation purposes.

(2) Data Analysis

Data obtained from the study were analyzed statistically using the SPSS 18.0 software

application. Descriptive analysis was performed on demographic characteristics of study participants through frequencies and percentages. Independent-samples test was employed to determine the differences in core competencies at baseline among the experimental and control groups and the differences in core competency scores among the two groups before and after conducting the experiment.

(3) Quality control

In order to avoid the influence of irrelevant factors in the study, the variables were kept consistent in the implementation of the course except for the different teaching strategies.

2.3.4 Sample Independence Test

The study used an independence test algorithm that does not take into account sample partitioning to analyze the changes in the indicators of nursing students in the experimental and control groups. It is a test of independence based on the distance between X, Y using N sample points as the centroid, applying a univariate test with a weighting function on the remaining $N-1$ sample points, and then aggregating the test statistics by summing over all the test statistics. The principle is that if (X, Y) are not independent and have joint probability density functions, then there exists a point (x_i, y_i) in the probability space (x_i, y_i) , and there also exists a point (x_i, y_i) centered on a ball with radius r_i such that the joint probability distribution of X and Y is different from the product of the marginal distributions of the Cartesian products of the balls centered on the point (x_i, y_i) . But since it is not known which sample point (x_i, y_i) is this particular sample point, the ball can only be constructed using all sample points as the center point. The test is performed as follows: for each observation i , and each observation j , and $j \neq i, i \geq n, j \geq n$, define:

$$A_{11}(i, j) = \sum_{k=1, k \neq i, k \neq j}^n I\{d(x_i, x_k) \leq d(x_i, x_k)\} I\{d(y_i, y_k) \leq d(y_i, y_k)\} \quad (7)$$

$$A_{12}(i, j) = \sum_{k=1, k \neq i, k \neq j}^n I\{d(x_i, x_k) \leq d(x_i, x_k)\} I\{d(y_i, y_k) > d(y_i, y_k)\} \quad (8)$$

$$A_{21}(i, j) = \sum_{k=1, k \neq i, k \neq j}^n I\{d(x_i, x_k) > d(x_i, x_k)\} I\{d(y_i, y_k) \leq d(y_i, y_k)\} \quad (9)$$

$$A_{22}(i, j) = \sum_{k=1, k \neq i, k \neq j}^n I\{d(x_i, x_k) > d(x_i, x_k)\} I\{d(y_i, y_k) > d(y_i, y_k)\} \quad (10)$$

where $I\{\cdot\}$ is the schematic function.

Using the chi-square test, there is in turn:

$$\begin{aligned} S(i, j) &= \sum_{k=1}^2 \sum_{l=1}^2 \frac{\{A_{kl}(i, j) - A_k(i, j)A_l(i, j)/(N-2)\}^2}{A_k(i, j)A_l(i, j)/(N-2)} \\ &= \frac{(N-2)\{A_{12}(i, j)A_{21}(i, j) - A_{11}(i, j)A_{22}(i, j)\}^2}{A_1(i, j)A_2(i, j)A_1(i, j)A_2(i, j)} \end{aligned} \quad (11)$$

where $A_m = A_{1m} + A_{2m}$ and $A_m = A_{m1} + A_{m2}$ give the test statistics:

$$T = \sum_{i=1}^n \sum_{j=1, j \neq i}^n S(i, j) \quad (12)$$

In order to estimate the value of P under H_0 , the replacement test is used. The idea is to randomly change the order of samples, you can get a new set of sample data, and then you can calculate the test statistic of the replacement sample. Repeat the process of changing the order of the samples and calculating the test statistic of the replacement samples, multiple test statistics can be obtained, thus obtaining the empirical distribution function of the test statistic, i.e., the value of P can be calculated so as to infer whether the original hypothesis is valid or not.

Here the replacement test procedure for testing the independence of two random variables X and Y is:

a. Fix x_i and rearrange y_i so that a set of rearranged datasets is obtained as $(x_1, y_1^*), (x_2, y_2^*), \dots, (x_n, y_n^*)$.

b. Compute the test statistic T under the data set (x, y^*) .

c. Repeat steps a and b until the desired number of permutation repetitions is obtained.

This yields a distribution W of the test statistic T , and if the two variables are non-independent, then permutations of the original dataset should be rare, i.e., values larger than the test statistic T_0 obtained in the original dataset should occur rarely in this distribution. Conversely, if the two variables are independent, there should be nothing special about the original arrangement, and obtaining values larger than T_0 should be common in this distribution. Let the number of values larger than T_0 obtained from the permutation distribution W be q , the number of permutations be u , and the p value obtained in the permutation test be $\frac{q+1}{u}$. The smaller this p -value is, and the fewer the number of values from the permutation distribution W that are smaller than T_0 , the more likely it is that the two variables are related. The algorithm for the independence test without considering sample partitioning is shown in Figure 2.

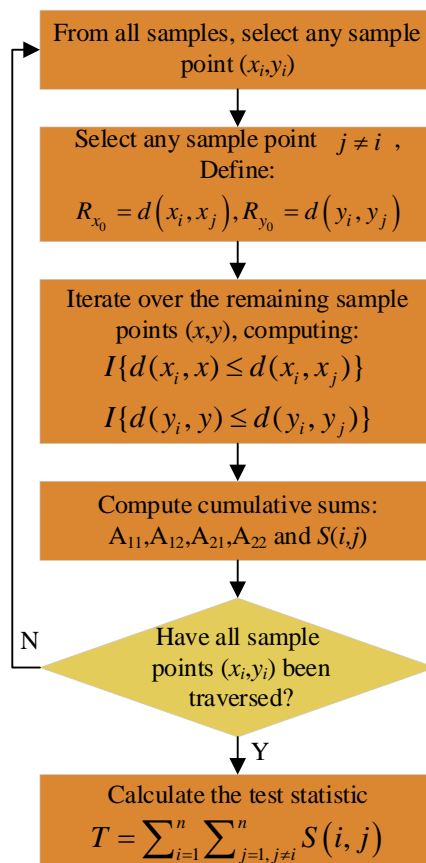


Figure 2: Independent inspection algorithm for sample partitioning

3 Analysis of the effectiveness of the implementation of practical training courses in nursing education

3.1 Comparison of test scores in diversity assessment

Academic performances of nursing students in both experimental and control groups were analyzed before and after instruction with regard to a number of parameters. These were:

(1) Formative evaluation: 10 points for each classroom performance, based on the nursing students' answers to questions, classroom discussions, and overall participation of myself and my group members were scored by the teacher and each group in the light of the classroom specifics, with 80% of the teacher's scoring and 20% of the group's scoring taken as the average. Assignments were graded by the teacher according to the submission and completion of the nursing students' assignments, which were divided into three grades: excellent, good, and qualified, and were given 10, 8, and 6 points, respectively. Teachers assessed the attendance of nursing students according to the attendance system established by the school, and full marks were given to those who were in full attendance during the semester. All the above grades are combined to get the usual classroom grades of the nursing students, and the stage test is conducted for the nursing students after the teaching content of each program, and the test questions are multiple-choice questions.

(2) Summative evaluation: The theoretical exam questions were extracted randomly from the "Basic Nursing Care" section of World Vocational College Nursing Skills Competition Test Bank, which includes all multiple choice questions that can earn up to 100 marks. Items for skills evaluation were selected randomly out of 15 standardized operations, with expert senior

educators involved in creating these test cases. All nursing students in both groups were tested for their skills by teachers not involved in instruction with 100 marks in total.

The pre-test score comparison outcomes of the groups for multidimensional evaluation are depicted in Figure 3, where Figure (a) represents the distribution of theoretical scores and Figure (b) represents the distribution of skill scores. Since no instructions had been provided to the students before conducting the experiment, routine marks of their performances were not taken into consideration in calculating the pre-test scores. There is no considerable difference between the pre-test theoretical and skill scores of the two groups, as the difference of theoretical score averages is 0.08 while that of skill score averages is 0.04. As per the results of the independent-samples test, the experimental observations were independent of those of the control group (no impact on each other), with no statistically significant difference in their pre-test scores ($p > 0.05$).

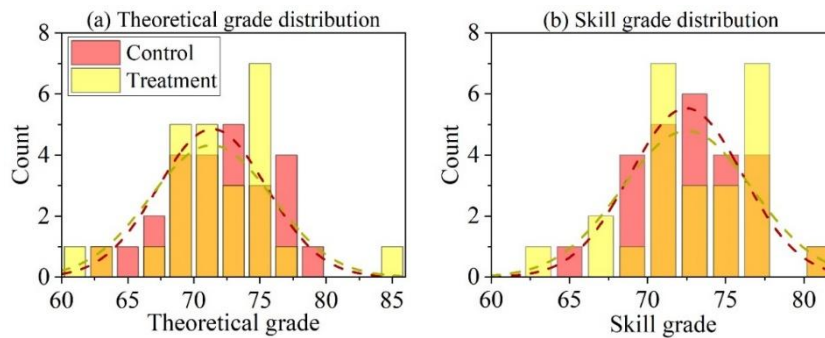


Figure 3: Comparison of the previous results of the two groups of nursing students

Figure 4 shows the post-test scores for both groups of nursing students after the multi-dimensional assessment. Statistical analysis was independently performed for routine performance, theory, and skills scores. The findings reveal that the experimental group scored significantly higher on average scores compared to the control group in all three variables, with an average score of 81.68 ($p < 0.05$) on routine performance, 83.6 ($p < 0.01$) on theoretical knowledge, and 89.12 ($p < 0.001$) on skills test scores. The difference in test scores between the experimental and control groups ranged from 2.96 to 12.04 points. This paper designs a practical training program in nursing education that effectively integrates the features of online and offline teaching and learning and effectively improves the academic performance of nursing students.

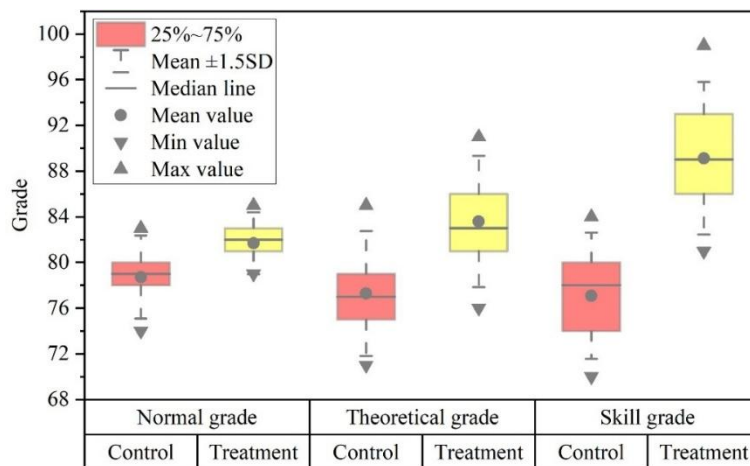


Figure 4: The comparison results of the evaluation results of the diversity evaluation

3.2 Analysis of nursing practical training skills final test

Skill examinations were conducted for the experimental and control groups, and examination and teaching were separated. According to the examination items, a number of senior teachers were invited to design relevant examination cases, and the examination cases were determined through the review of clinical nursing experts. Referring to the relevant scoring standards of the former “Comprehensive practical training in nursing”, both groups of nursing students were assessed for their skills in the practical training room, and three skills assessment items, namely, sealed intravenous infusion, single unarmed cardiopulmonary resuscitation, and urinary catheterization, were selected for the test. The two groups of practical training skills assessment results using uniform scoring standards, full of percent. The assessment was conducted by non-teaching teachers, with unified scales and unified supervision.

The independent samples test was carried out among the skills assessment marks of both groups, while the results of the three skill tests are shown in Figure 5. Nursing students in the experimental group scored an average mark of 88.56, 87.80, and 86.12 on the skill test of sealed intravenous infusion, single-person unarmed CPR, and urinary catheterization, respectively. The average marks earned by the control group were 80.76, 82.16, and 77.00, respectively. As can be seen from the graph, the marks scored by nursing students in the experimental group were significantly better than those recorded by the control group in all three skills assessment tests, $p < 0.05$. The above findings can be attributed to several factors.

First, the nursing education practicum course design technique adopted in this paper emphasizes the need for learners to engage in self-study using an e-learning model that utilizes students' extra-classroom hours. Secondly, the three-dimensional teaching objectives approach adopted recognizes nursing students as the core of the learning process, leveraging their interest and individual needs.

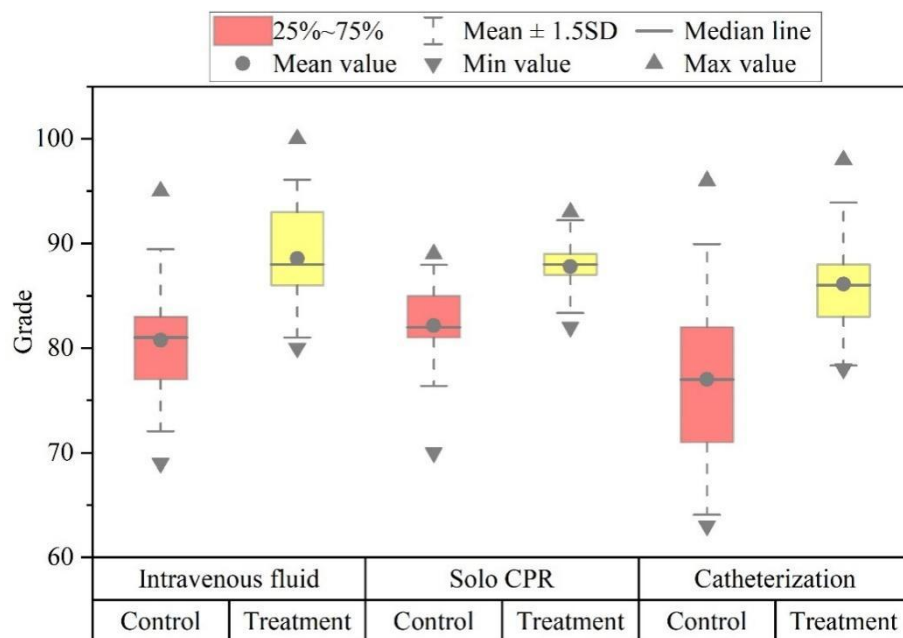


Figure 5: Two groups of nursing students who were able to test their skills

3.3 Impact of Nursing Students' Critical Thinking Skills

Critical thinking capability is one of the essential attributes that should be possessed by undergraduate nursing students and RNs. Students endowed with good critical thinking skills are more likely to cope with the diverse and complex nature of clinical settings and thus ensure

patient safety and positive health outcomes for patients. In the current study, the researchers have designed a special questionnaire to evaluate the difference in critical thinking ability of the experimental and control groups among undergraduate nursing students based on seven aspects: truth-seeking, open-mindedness, analytical thinking, systematic thinking, confidence, curiosity, and cognitive maturity.

Table 1 shows the variation in critical thinking ability between the experimental and control groups. Before the experiment, the average value ranges between 2.52 and 3.56 points in the experimental group and from 2.58 to 3.51 points in the control group, respectively, without any significant differences between the two groups in each aspect ($p > 0.05$). After the experiment, it can be found that there is a notable improvement in the scores of critical thinking ability among the experimental group, while the scores of the control group are relatively lower. There are significant differences in the scores of each critical thinking dimension between the two groups ($p < 0.05$). The nursing education practicum course design approach in this study combines several student-oriented teaching approaches, such as case-based learning, multidimensional goal-based teaching, situational teaching, and blended teaching, which work together to improve the critical thinking ability of nursing students.

Table 1: Changes in the critical thinking ability of two groups

Dimensions	Test	Mean±SD		T	P
		Control	Treatment		
Look for the truth	Pre	2.69±0.485	2.63±0.443	0.464	0.451
	Post	3.03±0.443	4.12±0.459	4.398	0.003**
Open mind	Pre	3.24±0.416	3.15±0.408	0.371	0.606
	Post	3.75±0.333	4.23±0.385	3.497	0.015*
Analytical ability	Pre	2.52±0.429	2.58±0.471	0.685	0.479
	Post	3.24±0.416	3.87±0.308	3.414	0.021*
Systematization	Pre	3.06±0.353	3.10±0.319	0.664	0.546
	Post	3.24±0.384	4.41±0.312	4.407	0.000***
Confidence in thinking	Pre	2.61±0.338	2.64±0.405	0.602	0.587
	Post	3.13±0.365	4.08±0.453	4.561	0.009**
Thirst for knowledge	Pre	3.56±0.417	3.51±0.423	0.388	0.489
	Post	3.78±0.334	4.63±0.157	6.453	0.000***
Cognitive maturity	Pre	3.16±0.426	3.15±0.431	0.573	0.527
	Post	3.49±0.447	4.33±0.308	5.384	0.006

Note: *, **, *** represent p significant at 0.05, 0.01, and 0.001 levels, respectively.

3.4 Comparison of general self-efficacy before and after the experiment

This research used the revised version of the General Self-Efficacy Scale in Chinese, whose purpose was to measure the general self-efficacy of nursing students according to their evaluation through four main areas: self-confidence of learning abilities, self-confidence of learning behaviors, problem solving capability, and emotional stability. The scale included scores on a 5-point Likert scale, which ranged from total lack of adherence to total adherence to the question posed; the scores ranged from 1 to 5. Using the independent samples test method, the average scores on the self-efficacy of nursing students before and after the experiment were acquired and represented in Table 2 below. There was no statistically significant difference found between the experimental group and the control group in terms of all four aspects before the experiment: self-confidence of learning abilities, self-confidence of learning behaviors, problem solving capabilities, and emotional stability ($p > 0.05$). However, after the experiment,

the average scores of the experimental group were 4.23, 4.55, 4.17, and 4.08 on the four indicators respectively, while those of the control group still remained significantly lower in the range from 3.26 to 3.47.

In this sense, self-efficacy is considered one of the most effective predictors of academic success. Nursing students of the experimental group showed a significantly higher level of self-confidence concerning their ability to deal with issues individually. Prior experience, training, and feedback are listed as the key factors affecting the development of self-efficacy among nursing students. It means that nursing skills training implemented via the developed practicum course design strategy can contribute to the improvement of self-efficacy among nursing students. Intrinsic motivation to learn among nursing students is positively associated with self-efficacy. The higher level of self-efficacy of nursing students means that they are more motivated, and they are more prone to change their learning strategies and approaches accordingly to achieve set goals. Additionally, they are more likely to be confident about dealing with challenges and using different resources for acquiring knowledge.

Table 2: The self-efficacy scores were scored before and after the experiment

Dimensions	Test	Mean±SD		t	p
		Control	Treatment		
Learning ability confidence	Pre	3.27±0.465	3.26±0.472	0.441	0.716
	Post	3.53±0.566	4.23±0.317	4.576	0.008**
Learning behavior confidence	Pre	3.44±0.319	3.47±0.411	0.535	0.608
	Post	3.87±0.357	4.55±0.218	4.408	0.003**
Problem resolution	Pre	3.31±0.418	3.28±0.405	0.547	0.741
	Post	3.76±0.462	4.17±0.312	5.511	0.017*
Emotional state stability	Pre	3.39±0.537	3.42±0.437	0.517	0.704
	Post	3.45±0.522	4.08±0.325	6.561	0.008**

Note: *, ** represent p significant at 0.05, 0.01 level, respectively.

3.5 Evaluation of the design of the practical training program in nursing education

The objective of course design evaluation is to ensure constant improvements and optimizations of the instructional processes. After conducting the experiment, the participants were asked to complete a survey to evaluate the course design for nursing education practicum offered by this paper. These survey questions were organized in five characteristics: goals and information, support, problem solving, feedback, and authenticity. The evaluations of the nursing education practicum course design conducted by the experimental group are provided in Figure 6 below. The mean scores of the five features of the practical nursing education training course design in this paper were all higher than 4. The mean scores of the problem-solving feature and the feedback feature of the course design were higher, at 4.65 and 4.62, respectively. This is followed by the goal and information feature and the simulation realism feature, with average score values of 4.51 and 4.48, respectively. And lastly, the supportive features with an average score of 4.31.

In this paper, the nursing education practical training course design strategy with clear content and sufficient information about nursing simulation, all these information and prompts can be perceived and understood by nursing students, thus encouraging them to participate in the nursing course activities and supporting them to solve the problems encountered in the simulation teaching and learning activities. In addition, factors from clinical reality were restored to the simulation course activities so that nursing students perceived that the simulation

mimicked a realistic clinical environment, and the guided feedback strategies were timely and effective. It enables nursing students to analyze their own behaviors and improve their understanding of knowledge and skills to another level, which ensures the teaching effectiveness of practical nursing education training.

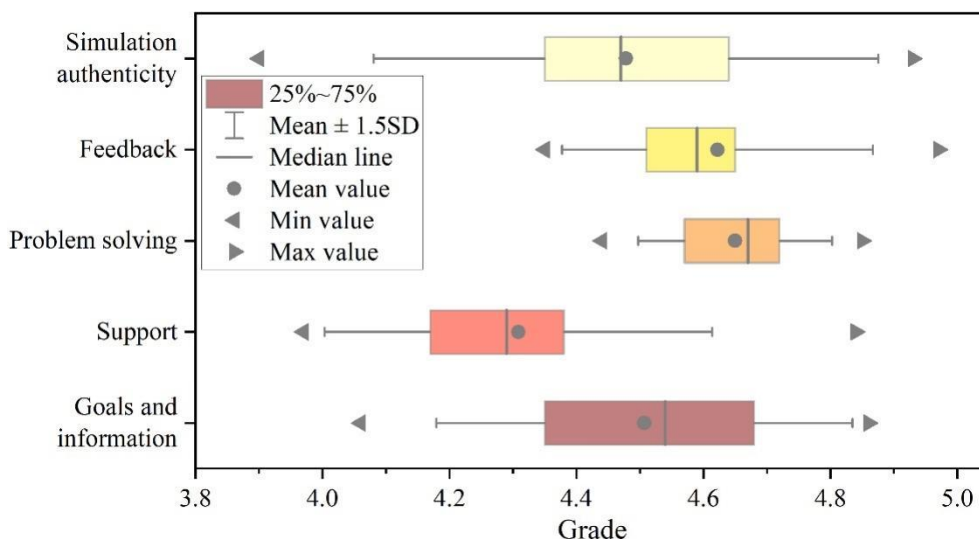


Figure 6: The evaluation of the training course design of education

4 Conclusion

In this paper, an online educational assistance model was designed and applied to the design of nursing education practical training courses, and a blended teaching model based on three-dimensional teaching objectives was proposed and implemented in Y Vocational Medical College. Both experimental and control groups were subjected to pre-tests and post-tests, and an independent-sample test was employed to make quantitative comparisons between the experimental group and control group regarding the comparison between their theoretical scores, skill scores, and any other pertinent factors.

After the conclusion of the instructions, the multidimensional evaluation scores of the nursing students in the experimental group ranged from 81.68 to 89.12, suggesting improvements of 2.96 to 12.04 compared with the control group.

In the evaluations for skills associated with sealing intravenous infusion, one-person unarmed cardiopulmonary resuscitation, and urinary catheterization, the experimental group scored 88.56, 87.80, and 86.12 respectively, which were clearly superior to those nursing students in the control group.

Additionally, questionnaire analysis revealed that the critical thinking skills and overall self-efficacy of the nursing students in the experimental group increased markedly, with statistically significant differences between the two groups.

In this paper, the goals of the nursing education practical training course design and the five characteristics of information, support, problem solving, feedback, and simulation authenticity scores ranged from 4.31 to 4.65, demonstrating a better effect of nursing education practical training.

About the Author

Chan Tang, Lecturer, Master of Nursing, Professional teachers from the Medical College, Chengdu Polytechnic. Teach core professional courses including basic nursing techniques, mental disorder nursing, emergency nursing, clinical nursing skills training, and commonly used nursing techniques for the elderly. Member of national-level teaching team of course ideology and politics, member of national-level model course team of course ideology and politics. Chairing the university-level boutique open course “Clinical Nursing Skills Practical Training”, the course ideology and politics demonstration course “Clinical Nursing Skills Practical Training” and “Common Nursing Techniques for the Elderly”, and the dual-creation fusion course “Clinical Nursing Skills Practical Training”. Editor-in-chief and co-editor of a number of textbooks, including “Basic Nursing Techniques”, “Practical Tutorial on Basic Nursing Skills”, “Care for the Elderly”, “Clinical Nursing Skills Practical Training”, “Emergency Nursing”, “Psychiatric Nursing”, “Normal Elderly Care”, “Common Diseases of the Elderly”, and “Nurse Normalized Training Materials”; and the publication of a monograph, “Care for the Elderly in the Elderly with Mental Illness”. She has published more than 10 papers. She has won one second prize at national level and one first prize at provincial level in Teachers' Teaching Ability Competition, one second prize and two third prizes at national level in Teachers' Practical Skills Competition, one second prize and one third prize in Provincial Teachers' Lecture Competition, and has guided her students to participate in Vocational College Nursing Skills Competition since 2014, which has won two first prizes, two second prizes and one third prize at national level, five first prizes and one second prize at provincial level. Since 2014, she has instructed students to participate in the nursing skills competition of vocational colleges and universities, winning 2 first prizes, 2 second prizes and 1 third prize at national level, 5 first prizes and 1 second prize at provincial level.

Xin Zhang, Engineer, Master of Software Engineering graduate, General Manager of Sichuan Dianzhi Technology Co., Ltd.. With years of expertise in software development, computer vision image processing, and AI technology R&D and application, our solution leverages Chengdu Hi-Tech Zone's industrial resources to deliver digital transformation solutions for government and enterprise clients, backed by extensive experience in technology R&D and enterprise management.

References

- [1] Gibson, S., & Molloy, E. (2012). Professional skill development needs of newly graduated health professionals: A systematic literature review. *Focus on Health Professional Education: A Multi-Professional Journal*, 13(3), 71-83.
- [2] Wang, H. (2022). Analysis On the Existing Problems and Methods of Nursing Vocational Education in China. *International Journal of Management and Education in Human Development*, 2(3), 554-557.
- [3] Cai, F. C., & Xi, H. F. (2015). Study weariness of vocational college students and reform of the teaching mode in Nursing Basic Technology course. *Chinese Nursing Research*, 2(1), 6-8.
- [4] Zhang, Y., Zhou, C., & Cao, S. (2024). Current Status and Influencing Factors of Nursing Students' Health Education Ability in Tertiary Vocational Colleges in Nanjing China. *Advanced Medical Research*, 3(1), 1-8.

- [5] Li, C., Huang, J., Wang, J., Yang, J., & Tian, G. (2019, July). Study and Practice on Skills Competition Help Vocational Education Students Growing up. In IOP Conference Series: Materials Science and Engineering (Vol. 573, No. 1, p. 012073). IOP Publishing.
- [6] Liang, Y., Liu, W., Li, X., Zhang, Y., & Yang, L. (2024). 2022 Shandong Province university medical technical skills competition nursing track: An effective project to improve core competencies of nursing students. *Heliyon*, 10(4).
- [7] Ho, C. F., & Chao, S. Y. (2020). Evaluating the health and social care competences of nursing students using skills competition. *Hu Li Za Zhi*, 67(4), 61-71.
- [8] Rooddehghan, Z., Azimi, N., HasanBaklu, Z., Baseri, S., & Karimi, R. (2025). Designing, implementing and evaluating a group educational competition to improve specialized skills, professional ethics and health-oriented lifestyle in nursing students of Tehran University of Medical Sciences: A study of educational development. *Development Strategies in Medical Education*, 11(2), 133-150.
- [9] Sung, H. Y. (2022, June). A competition-based problem-posing approach for nursing training. In *Healthcare* (Vol. 10, No. 6, p. 1132). MDPI.
- [10] Gaffney, M. K. (2025). The Skills Olympics: Using Competition to Illustrate Patient Care Challenges and Promote the Transfer of Nursing Knowledge. *Nursing Education Perspectives*, 46(3), 200-201.
- [11] Luo, Z., Wang, Q., Li, J., Chen, H., Li, H., Xue, K., & Tang, J. (2025). Challenges and coping strategies of nursing interns in training for nationwide medical technical skills competition: a qualitative descriptive study. *BMC nursing*, 24(1), 730.
- [12] Liu, L. (2024). Exploring the Teaching Reform of Promoting Learning by Competition and Promoting Teaching by Competition. *Curriculum Learning and Exploration*, 2(1).
- [13] Ruan, Y., Zhang, J., Wang, J., Jian, R., Mei, F., Li, H., ... & Tian, Y. (2025). Academic competition-based learning cultivates scientific literacy to promote professional competitiveness in medical undergraduates. *Frontiers in Public Health*, 13, 1590832.
- [14] Merino, M. D. F. G. L., Carvalho, M. D. B., Pelloso, S. M., Baldissera, V. D. A., & Higarashi, I. H. (2018). Nursing theories in professional training and practice: perception of postgraduate nursing students. *Rev Rene*, 19(1), 21.
- [15] Yu, H., & Wen, G. (2025). Cultivating healthcare innovators: a cross-sectional study on entrepreneurial abilities and influencing factors among nursing undergraduates. *BMC nursing*, 24(1), 678.
- [16] Tan, M., Liu, H., Xiang, Y., Xiong, L., Zou, L., & Fang, L. (2025). Practical research on the cultivation of inter-disciplinary undergraduate nursing talents in the context of “big health”. *BMC Medical Education*, 25(1), 717.
- [17] Liu, L., Qiu, X., Li, Y., & Yang, J. (2021). Investigation research on the demand of pre-job training for nursing students in higher vocational colleges. *medRxiv*, 2021-07.
- [18] Rao, B. J. (2019). Innovative teaching pedagogy in nursing education. *International*

Journal of Nursing Education, 11(4), 176-180.

- [19] Canfield, S. J. (2024). Cultivating Growth in Nurses: Nursing Continuing Professional Development. *New Mexico Nurse*, 69(1), 5-6.
- [20] Li, B. Z., Cao, N. W., Ren, C. X., Chu, X. J., Zhou, H. Y., & Guo, B. (2020). Flipped classroom improves nursing students' theoretical learning in China: a meta-analysis. *PloS one*, 15(8), e0237926.
- [21] Yingdong, C., Yaru, F., Huan, L., & Rui, H. (2024). Research on the Innovation of Practical Training Teaching in Nursing Programs under the Perspective of Disciplines. *International Journal of New Developments in Education*, 6(3).
- [22] Towfik, A. F., Hafez, S. H., Abualruz, H., Mohamed, H. A., Mohamed, N. A., & Mahgoub, S. A. E. F. (2023). Bridging the gap between theory and practice: Applying problem based learning strategy to improve nursing students' achievement. *Tanta Scientific Nursing Journal*, 30(3), 127-137.
- [23] Mathisen, C., Heyn, L. G., Jacobsen, T. I., Bjørk, I. T., & Hansen, E. H. (2022). The use of practice education facilitators to strengthen the clinical learning environment for nursing students: a realist review. *International Journal of Nursing Studies*, 134, 104258.
- [24] Yayla, A., & Ilgin, V. E. (2023). Cultivating Innovative Behavior and Creative Thinking among Nursing Students: An Intervention Study. *International Journal of Caring Sciences*, 16(3), 1262-1270.
- [25] Liu, H. Y., Wang, I. T., Huang, D. H., Hsu, D. Y., & Han, H. M. (2020). Nurturing and enhancing creativity of nursing students in Taiwan: a quasi-experimental study. *The Journal of Creative Behavior*, 54(4), 799-814.