Development and Implementation of a Multidimensional Assessment and Evaluation System for the Basic Nursing Course in a Blended Learning Mode

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Abstract: Objective: To explore the implementation and effectiveness of a diversified assessment and evaluation system in the Basic Nursing course under a blended learning mode. Methods: A total of 110 second-year undergraduate nursing students were selected as the study participants. Traditional teaching and assessment methods were applied during their first semester, while blended learning and diversified assessment were implemented in the second semester. Students' self-directed learning ability, satisfaction, and course objective attainment were evaluated at the end of each semester. Results: Compared with the first semester, the second semester showed significant improvements in academic performance, self-directed learning ability, course satisfaction, and course objective attainment ($P < 0.05$). However, no significant difference was observed in the improvement of practical skills in the satisfaction survey ($P > 0.05$). Conclusion: The blended learning mode and diversified course assessment and evaluation system help enhance students' learning motivation and initiative, thereby improving teaching effectiveness.

***Keywords*:** blended learning; diversified assessment; Basic Nursing

1. Introduction

With the deepening integration of information technology and education, blended learning has become a dominant approach in higher education. Leveraging the abundant resources available online, the blended learning model enables students to engage in "online self-directed learning + offline advanced learning" [1]. The teaching structure that combines "teacher-led and student-centered" approaches not only demonstrates teachers' roles in monitoring, inspiring, and guiding instruction but also emphasizes students' initiative, creativity, and motivation in learning [2]. This approach significantly enhances classroom dynamism, enriches teaching methods, stimulates students' learning interest, and improves their learning capabilities [3].

The overall design of online-offline blended learning directly influences the methods and effectiveness of course assessment and evaluation. However, in existing offline teaching sessions, the focus is often on clarifying key and difficult points from online video content, with insufficient design of project-based discussions [4]. Additionally, components such as assignments, quizzes, midterm exams, and final exams in the current assessment and evaluation framework tend to emphasize summative evaluation [5]. Therefore, refining the process evaluation mechanism, incorporating personalized and optional assessment content, and strengthening diversified, comprehensive evaluation methods [6] are key directions for reforming assessment and evaluation in blended learning courses.

Basic Nursing is a core course in the nursing major, typically offered over two semesters in the second year of a four-year program. It requires students to master the fundamental theories, knowledge, and skills of nursing. The course features fragmented theoretical knowledge and strong practical applicability, with a theory-to-practice credit ratio of 1:1. Currently, many institutions still adhere to traditional teaching methods, such as theoretical lectures, demonstrations by instructors, and independent student practice, which often results in suboptimal learning outcomes. In response to these characteristics, the course team has actively implemented online-offline blended learning based on an existing online course platform ("Zhihuishu") and designed a corresponding course assessment and evaluation system.

2. Research Subjects and Methods

2.1 Research Subjects

A total of 110 undergraduate nursing students from the class of 2023 were selected as the research subjects. During the first semester of their sophomore year, traditional teaching methods (combining theoretical instruction with practical exercises) were implemented. In the second semester, blended learning was introduced. All participants provided informed

consent and voluntarily participated in the study. No significant differences were observed among the students in terms of gender, age, prior academic performance, teaching materials, or instructors ($P > 0.05$).

2.2 Methods

2.2.1 Implementation and Evaluation of Blended Learning

(1) The teaching model was designed into three phases: pre-class online self-study, in-class offline exploratory learning, and post-class extended practice .Pre-class Preparation (Online Learning): Students were required to complete assigned course resources and participate in corresponding online assessments before class to achieve knowledge-based objectives. In-class Exploration (Offline Learning): Based on the outcomes of pre-class learning, instructors dynamically adjusted teaching content, addressed challenging topics identified during online learning, and facilitated exploratory activities.Post-class Extended Practice: Depending on the course content, practical activities were conducted either on or off campus. The outcomes were shared on an online platform for further discussion and exchange.

(2) Diversified Assessment and Evaluation: Under the blended learning mode, students' learning behaviors have undergone significant changes, prompting the assessment system to be designed around the entire learning process. Formative assessment (accounting for 60% of the total evaluation) comprises online (30%) and offline (30%) components. The online assessment focuses on students' utilization of network resources for activities such as pre-class preparation, testing, assignments, and video-based learning. The offline assessment emphasizes classroom participation, completion of experiments, and the achievement of comprehensive competencies. Summative assessment (40%) employs theoretical or practical formats to holistically evaluate learning outcomes (see Table 1).

Table 1. Curriculum Assessment System for Blended Learning Mode

Primary Indicator	Secondary Indicator	Learning Method	Assessment	Evaluation Metrics	Evaluation Weight (%)
Online assessment	Preview & self-study	Video, text & images	Download and study, complete questions	Learning attitude, self-study effectiveness	5
	Online testing	Mainly objective questions	Complete independently	Knowledge comprehension	5
	Exercise discussion	Subjective questions, integrated with ideological-political elements	Form a Word document—learning portfolio	Learning ability, problem identification, professional ethos	5
	In-class testing	Objective & subjective questions	Conducted during class	Authenticity of self-study effectiveness	5
Offline assessment	Extended training	Literature review / field research	produce a report	Professional attitude,exploratory and research mindset	10
	Classroom performance	Identifying and raising questions	Ask questions	problem identification	5
	Practical learning	lab learning, practice	fulfill job responsibilities; communication skills	Professional identity, vocational spirit	5
	Self & peer assessment	presentations, group reports	Case/project completion	Teamwork, problem-solving ability, critical and innovative thinking	10
	Unit test	Objective & subjective questions	Periodic assessment	feedback-improvement	10
Summative assessment	Final examination	Theory / Skills assessment	Basic theoretical knowledge / case analysis / application	feedback-improvement	40

2.2.2 Traditional Teaching and Evaluation

(1) Theoretical knowledge was delivered through multimedia instruction. Pre-class preview assignments were distributed, questions were raised and addressed during class, and post-class review and homework completion were emphasized. For practical training modules, demonstration teaching was conducted by the instructor, followed by small-group practice sessions among students.

(2) Assessment consisted of two components: formative assessment and a final examination. Formative assessment accounted for 60% of the total grade, including assignments, classroom performance (5%), unit tests (10%), reading notes (10%), laboratory performance (15%), and the midterm examination (20%). The final examination accounted for 40% and comprised both objective and subjective questions.

2.3 Evaluation Indicators

(1) Course Objective Attainment: Based on the comprehensive evaluations of students at the end of the two semesters, the

attainment of course objectives was compared and analyzed. Factors such as instructional delivery by teachers, alignment of formative assessments with course objectives, difficulty level of final examinations, grading, and proctoring were consistent across both semesters, ensuring comparability.

(2) Student Self-directed Learning Ability: The "Self-directed Learning Ability Scale for Nursing Students" developed by Zhang Xiyan et al. [7] was used to investigate students' self-directed learning ability. The scale demonstrated good reliability and internal consistency, with a Cronbach's α coefficient of 0.822. The scale includes four dimensions: learning motivation, self-management ability, cooperation ability, and information literacy, comprising a total of 30 multiple-choice items. Each item is scored on a 1–5 scale, with total scores ranging from 30 to 150. Higher scores indicate stronger self-directed learning ability. The scale was administered anonymously, collected on-site, and achieved a 100% valid response rate.

(3) Student Satisfaction: Student satisfaction was assessed through a questionnaire survey. All 110 students participated in the survey, with 106 valid responses collected, resulting in a valid response rate of 96.36%.

2.4 Statistical Analysis

Data analysis was performed using SPSS 25.0. Measurement data are presented as mean ± standard deviation (Mean ± SD), and t-tests were conducted for comparisons. Ranked data were analyzed using the Mann–Whitney U test. A P-value < 0.05 was considered statistically significant.

3. Results

3.1 Course Objective Attainment

Students are required to master fundamental nursing theories and techniques, demonstrate the ability to deliver holistic care and address clinical problems, and develop a rigorous, responsible professional attitude along with a collaborative mindset.The average scores of formative assessments, final examinations, and course objective attainment in the second semester were significantly higher than those in the first semester, with statistically significant differences ($P < 0.05$). This indicates that the blended learning can effectively enhance students' learning interest and motivation while enabling a more comprehensive evaluation of their learning outcomes(see Table 2).

Table 2. Comparison of final comprehensive evaluation and course objective attainment

Semester (Group)	n	Formative Assessment Score (Mean ± SD, points)	Final Exam Score (Mean ± SD, points)	Knowledge Objective Attainment	Competency Objective Attainment	Literacy Objective Attainment
First semester (control group)	110	82.33±2.01	70.35±1.88	0.762	0.774	0.748
Second semester (observation group)	110	86.63±3.74	74.48±2.54	0.793	0.821	0.788
t-value		-10.62	-13.70			
P-value		<0.01	<0.01			

3.2 Student Self-directed Learning Ability

Through the implementation of online-offline blended learning and diversified course assessment and evaluation, students' self-directed learning ability significantly improved in the second semester, with statistically significant differences ($P < 0.05$). The results are shown in Table 3.

Table 3. Comparison of students' self-directed learning ability scores (mean ± sd, points)

Item	First Semester (Control Group)	Second Semester (Observation Group)	t-value	p-value
Learning motivation	28.26±1.37	30.46±2.11	-9.17	0.000
Self-management ability	38.72±2.40	40.18±2.77	-4.18	0.000
Information literacy	21.25±2.56	24.36±1.84	-10.35	0.000
Total score	106.67±4.09	114.94±4.26	-14.69	0.000

3.3 Student Satisfaction

As shown in Table 4, blended learning significantly enhances students' learning interest, cognitive skills, and satisfaction with teaching quality. However, no statistically significant difference was observed between the two groups regarding the improvement of hands-on operational skills.

Table 4. Student evaluation of teaching satisfaction [n (%)]

Item	First Semester (Control Group)	Second Semester (Observation Group)	X^2
Satisfaction with pre-class tasks assigned by the instructor	84 (76.36)	95 (86.36)	3.84 *
The group activities designed by the instructor were interesting	82 (74.55)	101 (91.82)	11.56 **
Satisfaction with teaching methods and design in class	86 (78.18)	98 (89.09)	4.13 *
Practical training classes improved my hands-on operational skills	94 (85.45)	98 (89.09)	0.62
The course helped improve my teamwork and collaboration skills	89 (80.91)	100 (90.91)	4.70 *
The course helped enhance my clinical critical thinking	83 (75.45)	97 (88.18)	8.11 **

Note: * indicates $P < 0.05$; ** indicates $P < 0.01$.

4. Discussion

The online-offline blended learning model, structured around a triple helix of "online resource preparation + offline in-depth interaction + data-driven improvement," emphasizes the integration of teaching and mentoring in a "student-centered" learning environment, creating a truly highly engaged and personalized learning experience for students [8]. This approach not only transfers lower-order tasks such as knowledge transmission online, freeing up valuable offline time for higher-order cognitive training, but also enables precise teaching and early-warning interventions through the analysis of learning behavior data, aligning with the "two attributes and one degree" standards set by the Ministry of Education for the development of "golden courses." However, this new teaching model urgently requires corresponding innovations in course assessment and evaluation [9], aiming to achieve synergistic resonance across the three dimensions of "knowledge, skills, and literacy."

Knowledge objectives, focusing on the systematic mastery of foundational concepts, can be assessed through online question banks and adaptive tests for lower-order diagnostic purposes. Skill objectives, centered on clinical thinking, comprehensive practice, and problem-solving, can be evaluated via offline scenario simulations and project-based tasks, supplemented by online peer assessments and instructor feedback, enabling process-oriented and authentic evaluation. Literacy objectives, emphasizing professional ethics, collaborative spirit, and lifelong learning awareness, can be monitored through qualitative and quantitative indicators such as engagement in online learning communities, reflective journals, and contributions to cross-group collaborative projects.

This study confirms that blended learning and diversified assessments significantly enhance learning abilities and teaching quality. However, no significant difference was observed in the improvement of hands-on nursing technical skills compared to the control group. This may be attributed to the longstanding emphasis on practical teaching in this course, coupled with relatively simplistic evaluation dimensions. The survey merely inquired about "whether hands-on abilities improved," without distinguishing finer indicators such as proficiency or precision. It also highlights shortcomings in the depth of practical teaching, resource integration, and digital literacy. Future iterations could consider upgrading the practical training chain to a "scenario-task-reflection" triphase model, promoting deeper integration of technology and teaching, and advancing blended learning from "superficial blending" to "deep blending" through virtual simulation technologies or embedded VR case studies.

To ultimately achieve the three-dimensional goals of "knowledge, skills, and literacy" in a course, it is essential to backward-design diverse components such as online micro-lessons, offline situational training, and peer collaboration, ensuring each step aligns precisely with the objectives. Simultaneously, the diversified assessment and evaluation system functions as a real-time navigational beacon, allowing instructors to fine-task difficulty and pacing accordingly. Ultimately, this forms a closed-loop cycle of "objectives → components → evaluation → feedback → improvement," continuously driving pedagogical reforms into deeper waters and achieving a spiral ascent in teaching quality through iterative refinement.

Acknowledgments

This paper was supported by the following fund project: Teaching Reform Project of Qingdao Binhai University “Research on Outcome-Based Online and Offline Blended Course Assessment and Evaluation System” (2024JC18).

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