

Research on Formative Assessment Based on Learning Communities in the Development of Clinical Competency for Internal Medicine Nursing Students

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Abstract: *Objective:* To explore the effect of formative assessment based on a learning community on cultivating job competency among nursing students in internal medicine. *Methods:* Nursing students rotating in the neurology department from April 2024 to April 2025 were selected and assigned into a control group (admitted for internship from April to September 2024) and an experimental group (admitted from October 2024 to April 2025) according to their rotation periods using a concurrent non-randomized controlled design. The control group received conventional teaching and summative evaluation at the end of the rotation, while the experimental group was provided with a learning community framework and implemented continuous formative assessment throughout the rotation. Job competency, theoretical examination scores at the end of the rotation, and teaching satisfaction were compared between the two groups. *Results:* There was no statistically significant difference in job competency scores between the two groups before intervention ($p > 0.05$). After intervention, the experimental group showed significantly higher scores in all dimensions and total job competency scores than the control group ($p < 0.001$), as well as higher theoretical examination scores and teaching satisfaction ($p < 0.05$). *Conclusion:* Formative assessment based on a learning community can provide timely feedback on students' learning processes, enhance job competency and theoretical knowledge among nursing students in internal medicine, and improve teaching satisfaction.

Keywords: Learning community; Job competency; Clinical nursing education

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1. Introduction

Clinical internship is a crucial phase in nursing education that bridges theory and practice, during which students develop job competency that directly influences their professional adaptation and the quality of clinical care^[1]. The National Nursing Development Plan (2021–2025) explicitly calls for establishing a nurse training system centered on job competence, thereby setting higher demands for clinical nursing education.

Neurology patients often experience rapid changes in condition, frequently presenting with consciousness disturbances, swallowing difficulties, and motor impairments, placing high demands on nursing students' abilities in patient observation, clinical judgment, and communication and collaboration ^[2]. Currently, most clinical internship assessments rely on summative evaluations at the end of rotations, which fail to identify learning issues promptly and hinder timely teaching feedback and continuous improvement ^[3]. Formative assessment emphasizes collecting information throughout the learning process and providing immediate feedback through various methods such as self-assessment, teacher evaluation, and peer assessment. A learning community refers to an organized group where members collaborate and progress together toward shared goals. Integrating these two approaches provides formative assessment with a stable organizational structure and active participants for peer evaluation, while using evaluation feedback to sustain the ongoing development of the community. This article combines formative assessment and learning communities in clinical instruction for nursing students in neurology, aiming to offer practical insights into enhancing students' job competence in internal medicine. The following presents the application and outcomes.

2. Materials and methods

2.1. General information

Seventy nursing students who completed their clinical internship in the Department of Neurology at our hospital from April 2024 to April 2025 were selected as participants. Inclusion criteria included full-time undergraduate or higher-level nursing students currently enrolled in an academic program, having completed a four-week rotation in neurology, and providing informed consent to voluntarily participate in this study. Exclusion criteria included those who took more than three cumulative days off during the internship period, or those who withdrew midway or transferred to another department. Based on the time of admission for clinical training, students were divided into a control group (admitted between April and September 2024) and an experimental group (admitted between October 2024 and April 2025). Upon admission, students were randomly assigned to learning groups by drawing lots, with each group consisting of 3–4 members, forming a total of 20 groups—10 groups per cohort, each containing 35 students. No dropouts occurred during the study. The control group consisted of 4 males and 31 females, aged 19–24 years (mean age: 21.46 ± 1.12 years); educational background: 19 with bachelor's degrees and 16 with associate degrees. The experimental group included 3 males and 32 females, aged 19–24 years (mean age: 21.63 ± 1.05 years); educational background: 18 with bachelor's degrees and 17 with associate degrees. Comparisons of gender (Fisher's exact test, $p = 1.000$), age ($t = 0.655$, $p = 0.515$), and education level ($\chi^2 = 0.057$, $p = 0.811$) between the two groups showed no statistically significant differences, indicating comparability. This study was approved by the Medical Ethics Committee of our hospital.

2.2. Method

2.2.1. Joint teaching method by two groups

Both groups of nursing students completed a four-week rotation in neurology, using the same teaching syllabus and curriculum content, with identical criteria for instructor qualifications. The teaching nurse manager and chief instructor developed a four-week training plan based on the syllabus and specialty characteristics of neurology, implementing one-on-one bedside teaching. Instructors were required to have at least five years of experience in neurology, hold a title of nurse or higher, and possess hospital-recognized

teaching qualifications. Each instructor followed the department's training plan to complete a detailed teaching task list, which included nursing care for common conditions such as stroke, epilepsy, myasthenia gravis, and Parkinson's disease; specialized skills like consciousness and pupil assessment, swallowing function screening, nasogastric feeding, proper positioning, fall prevention, and pressure injury prevention; patient-nurse communication; health education; and documentation of nursing records. The chief instructor delivered weekly mini-lectures and organized one teaching ward round per semester.

2.2.2. Control group

The control group received standard teaching and assessment methods based on the above-mentioned instruction. During the internship, instructors randomly provided guidance to nursing students without structured phased evaluations or feedback sessions. At the end of the internship, the chief instructor organized a unified theoretical examination and job competency assessment for all students in the group, which served as a summative evaluation.

2.2.3. Experimental group

Based on the collaborative teaching approach, the experimental group implemented formative assessment supported by a learning community, as detailed below.

(1) Establish a learning community

Form learning communities based on groups randomly assigned, including the corresponding teaching instructors. Each group appoints a team leader, a recorder, and a presenter, with these roles rotating weekly among members to ensure every student takes on different responsibilities such as organizing, recording, and presenting. On the first day of the rotation, the chief instructor organizes an introductory meeting for the community to explain internship objectives and evaluation methods, guiding each group to set individualized group learning goals and weekly plans according to their specific learning needs, thereby fostering a shared vision. The chief instructor utilizes a “personalized training platform” to serve as a resource-sharing and online communication hub for the community, regularly posting specialized nursing knowledge, procedural videos, and typical case studies.

(2) Evaluation of task list nodes

Each time a nursing student completes a task from the teaching task list, a formative assessment is conducted. The student performs self-evaluation using the task list evaluation record form, summarizes the operational procedures and knowledge mastery, reflects on personal shortcomings, and the preceptor provides specific feedback and demonstration guidance based on the student's self-assessment and observed issues. The preceptor also acknowledges and encourages the student's strengths demonstrated during nursing practice. Based on the feedback, the student develops improvement measures and undergoes re-evaluation in subsequent similar operations, thus forming a closed loop of evaluation, feedback, improvement, and re-evaluation.

(3) In-class instruction with immediate assessment and peer evaluation among groups

Weekly mini-lectures are conducted through group presentations combined with teacher-led instruction, incorporating classroom questioning and online instant assessments during the lecture to promptly gauge nursing students' understanding of key concepts, thereby adjusting teaching focus and pace accordingly. After each session, groups conduct mutual evaluations focusing on presentation content, accuracy of

knowledge, and team collaboration. Outstanding aspects are acknowledged and promoted, while areas needing improvement receive constructive feedback.

(4) Online interaction and self-directed learning

The lead instructor posts one online assignment per week via the “ Individualized Training Platform,” including case analyses, nursing care plan development, and knowledge quizzes. Group members first complete the assignments independently, then discuss within their groups to reach a consensus answer before uploading it. The instructor provides feedback within 48 hours, and common issues are addressed collectively during the next group session.

(5) Group reflection and phase evaluation

A group reflection meeting is held every Friday at 3:00 PM, during which members share their learning achievements and challenges of the week, and with the assistance of a recorder, submit the minutes to the supervising teacher. A mid-term evaluation is conducted in the second week of internship, where the supervising teacher provides a comprehensive assessment of nursing students based on task completion, online assignments, and peer evaluation results, and jointly identifies key areas for future learning with the students.

(6) Summative assessment

At the end of the internship, both the experimental group and the control group underwent theoretical examinations and evaluations of job competency simultaneously.

2.2.4. Quality control

All preceptors received standardized training prior to the study, covering the organization methods of learning communities, implementation procedures for formative assessment, feedback techniques, and the use of evaluation tools. Only those who passed the assessment were allowed to participate in mentoring. During the study, the lead preceptors conducted weekly spot checks on the completion of evaluation record forms to ensure that formative assessment proceeded as planned. The two groups of nursing students were mentored by different preceptors to minimize interference between groups.

2.3. Observation indicators

(1) Job competency

The nursing student job competency assessment scale was used to evaluate participants on the first day of admission (pre-intervention) and upon discharge (post-intervention). This scale, originally developed by Hu Bo et al. and revised by Liu Chunbo, consists of 36 items across five dimensions: personal traits, clinical nursing skills, support and interpersonal communication abilities, critical clinical thinking, and professional development and self-improvement. It uses a 5-point Likert scale, with scores ranging from 5 (fully competent) to 1 (not competent), resulting in a total score between 36 and 180. Each dimension is represented by the mean item score, with higher scores indicating stronger job competency. Evaluation was conducted jointly by two senior teaching instructors who had undergone standardized training and were unaware of group assignments; the average of their ratings was taken. In this study, the Cronbach’s α coefficient for the scale was 0.927.

(2) Theoretical assessment score upon departmental discharge

Exams were uniformly designed according to the teaching syllabus and conducted as closed-book tests,

with a maximum score of 100 points. The exam consisted of three sections: basic theory, specialized theory, and case analysis. Both groups of nursing students took the test simultaneously on the day of discharge.

(3) Teaching satisfaction

An anonymous survey on teaching satisfaction was conducted at the end of the rotation using a self-developed questionnaire by the department. The survey covered 10 aspects, including teaching content, teaching methods, timeliness of feedback, learning atmosphere, teamwork, and improvement in personal skills, with responses categorized into four levels: very satisfied, satisfied, neutral, and dissatisfied. Satisfaction rate = (number of very satisfied + number of satisfied) / total number of respondents $\times$ 100%. The content validity index of the questionnaire was 0.912.

2.4. Statistical analysis

Data were entered after double-checking by two individuals and analyzed using SPSS 22.0 statistical software. Continuous variables with normal distribution were expressed as mean $\pm$ standard deviation ($\bar{x} \pm s$), and group comparisons were performed using independent samples *t*-test; when variances were unequal, the *t*-test was applied. Categorical data were presented as frequencies and percentages, and group comparisons were conducted using χ^2 test; Fisher's exact probability method was used when expected frequencies were less than 5. A *p* value < 0.05 was considered statistically significant.

3. Results

3.1. Comparison of job competency scores between the two groups of nursing students before intervention

There was no statistically significant difference in the scores of each dimension and the total score of job competency between the two groups of nursing students before intervention (*p* > 0.05), as shown in **Table 1**.

Table 1. Comparison of job competency scores between the two groups of nursing students before intervention ($\bar{x} \pm s$, points)

Group	n	Personal traits	Clinical nursing competence	Support and interpersonal communication skills	Critical clinical thinking ability	Professional development and self-improvement capabilities	Total score
Experimental group	35	3.39 $\pm$ 0.44	3.08 $\pm$ 0.43	3.17 $\pm$ 0.48	2.96 $\pm$ 0.45	2.99 $\pm$ 0.46	113.12 $\pm$ 13.27
Control group	35	3.42 $\pm$ 0.41	3.05 $\pm$ 0.46	3.21 $\pm$ 0.45	2.93 $\pm$ 0.47	3.02 $\pm$ 0.49	113.46 $\pm$ 12.83
<i>t</i> -value		-0.295	0.282	-0.360	0.273	-0.264	-0.109
<i>P</i> -value		0.769	0.779	0.720	0.786	0.793	0.914

3.2. Comparison of job competency scores between the two groups of nursing students after intervention

After the intervention, the scores for each dimension and the total score of job competency in the experimental group were higher than those in the control group, with statistically significant differences (*p* < 0.001), as shown in **Table 2**.

Table 2. Comparison of job competency scores between the two groups of nursing students after intervention ($\bar{x} \pm s$, points)

Group	n	Personal Traits	Clinical Nursing Competence	Support and interpersonal communication skills	Critical clinical thinking ability	Professional development and self-improvement capabilities	Total score
Experimental group	35	4.21 $\pm$ 0.36	4.05 $\pm$ 0.38	4.12 $\pm$ 0.35	3.86 $\pm$ 0.41	3.91 $\pm$ 0.40	146.58 $\pm$ 10.47
Control group	35	3.84 $\pm$ 0.39	3.62 $\pm$ 0.42	3.71 $\pm$ 0.40	3.38 $\pm$ 0.44	3.47 $\pm$ 0.43	131.73 $\pm$ 11.62
<i>t</i> -value		4.124	4.491	4.564	4.722	4.432	5.617
<i>p</i> -value		< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001

3.3. Comparison of theoretical assessment scores between the two groups of nursing students upon completion of the rotation

The theoretical assessment scores in basic theory, specialty theory, case analysis, and the total score of the experimental group were all higher than those of the control group, with statistically significant differences ($p < 0.05$), as shown in **Table 3**.

Table 3. Comparison of theoretical assessment scores between the two groups of nursing students upon department discharge ($\bar{x} \pm s$, points)

Group	n	Fundamental theory	Specialty theory	Case analysis	Total score
Experimental group	35	34.12 $\pm$ 2.87	25.03 $\pm$ 2.61	23.74 $\pm$ 3.05	82.89 $\pm$ 5.92
Control group	35	32.47 $\pm$ 3.26	23.18 $\pm$ 2.94	20.36 $\pm$ 3.41	76.01 $\pm$ 6.85
<i>t</i> -value		2.247	2.784	4.371	4.496
<i>p</i> -value		0.028	0.007	< 0.001	< 0.001

3.4. Comparison of teaching satisfaction between two groups of nursing students

The teaching satisfaction in the experimental group was higher than that in the control group, and the difference was statistically significant ($p < 0.05$), as shown in **Table 4**.

Table 4. Comparison of teaching satisfaction between the two groups of nursing students [n (%)]

Group	n	Very satisfied	Satisfied	General	Not satisfied	Satisfaction
Experimental group	35	20 (57.14)	13 (37.14)	2 (5.71)	0 (0.00)	33 (94.29)
Control group	35	11 (31.43)	14 (40.00)	8 (22.86)	2 (5.71)	25 (71.43)
χ^2 value						6.437
<i>p</i> -value						0.011

4. Discussion

4.1. Formative assessment based on the development of a learning community helps enhance the job competency of nursing students in internal medicine.

The study results indicate that, after the intervention, the experimental group scored higher than the control group in all dimensions and the total score of job competency. This suggests that formative assessment based on a learning community can effectively enhance the job competence of nursing students in internal

medicine. Traditional summative assessment is conducted only at graduation, leaving nursing students with fragmented and unsystematic feedback during clinical practice. Problems are often identified only when they leave the department, missing the optimal window for correction and reinforcement ^[4]. In this study, formative assessment was implemented using teaching task checklists as milestones. After completing each task, students underwent self-assessment, teacher evaluation, feedback, and re-evaluation, enabling timely identification and improvement of weak points in their learning and continuous consolidation of clinical nursing skills. A significant difference was observed between the two groups in the dimension of critical clinical thinking, which may be related to the inclusion in the experimental group of online case analysis assignments, group discussions, and peer evaluations. Neurological patients often exhibit subtle changes in condition, requiring nursing students to detect early signs through careful observation of consciousness, pupils, muscle strength, and vital signs. By discussing real clinical cases, group members present diverse perspectives, challenge each other, and engage in argumentation, fostering habits of proactive thinking and comprehensive judgment. Role rotation within the learning community, establishment of shared goals, and group reflection promotes the development of communication, listening, and coordination skills among students, thereby enhancing their supportive and interpersonal communication abilities. Improvements in professional development and self-growth stem from the processes of self-assessment and reflection. Through continuous self-examination, nursing students gradually clarify their professional roles and career directions, cultivating awareness of proactive learning and self-improvement.

4.2. Formative assessment based on learning communities helps improve nursing students' theoretical knowledge.

The theoretical assessment scores in each section and the overall scores of the experimental group were higher than those of the control group, with a particularly significant difference observed in the case analysis section ^[5]. Formative assessment emphasizes the supportive role of evaluation in learning. Immediate assessments conducted during weekly lectures allow instructors to clearly understand students' grasp of key knowledge points, enabling timely adjustments to teaching priorities and preventing disconnection between teaching and learning. Online assignments require nursing students to complete tasks independently before discussing and formulating group answers through collaborative discussion. This process encourages students to consult resources and exchange perspectives, deepening their understanding of the subject matter. Instructors can then address common misconceptions collectively, helping to fill knowledge gaps. Case analysis questions assess students' ability to apply theoretical knowledge to clinical problems. The experimental group's clear advantage in this area demonstrates that formative assessment based on a learning community not only strengthens knowledge retention but also promotes the transfer of knowledge into clinical practice, effectively bridging the gap between academic education and clinical job requirements.

4.3. Formative assessment based on the development of a learning community helps enhance nursing students' satisfaction with teaching

The satisfaction level of the experimental group was higher than that of the control group. Nursing students newly entering clinical practice often face various pressures, such as unfamiliar environments, role transitions, and patient-nurse communication, which can lead to feelings of anxiety and helplessness. A learning community provides nursing students with a stable peer support system, where mutual encouragement and sharing of experiences during collaborative learning tasks help reduce psychological

stress and enhance a sense of belonging. In formative assessment, instructors not only point out shortcomings but also acknowledge students' strengths ^[6]. This feedback approach helps correct mistakes while motivating students, making them feel respected and valued, thereby increasing their enthusiasm and engagement in learning. The evaluators have shifted from the single instructor to include the students themselves, peers, and instructors, enabling students to transition from passive recipients of evaluation to active participants. This shift reflects the students' central role in the learning process and increases their acceptance of the teaching process. Notably, implementing formative assessment increases the workload for instructors. Clinical teaching managers should provide time support through flexible scheduling and reasonable distribution of teaching responsibilities, and incorporate the implementation of formative assessment into instructor quality evaluations to ensure the sustainable operation of this model.

4.4. Limitations of this study

This study is single-center research with a small sample size, involving nursing students on neurology rotation; therefore, the generalizability of the findings requires further validation. The two groups of nursing students were from the same department and used a concurrent non-randomized control design, which may introduce potential confounding factors such as time effects between groups. Assessment of job competency relied primarily on subjective evaluations by preceptors, introducing some bias. This study only observed short-term outcomes after the internship ended. Future studies could adopt a multi-center, large-sample design, extend to other internal medicine specialties, use objective evaluation tools such as Objective Structured Clinical Examinations (OSCEs), and conduct longitudinal follow-up of nursing students to explore the long-term effects of this assessment approach.

5. Conclusion

In summary, formative assessment based on learning communities integrates teamwork and process-oriented feedback, enabling dynamic monitoring of nursing students' learning progress. It effectively enhances the clinical competence and theoretical knowledge of medical-surgical nursing students, improves their satisfaction with clinical teaching, and offers valuable insights for reforming clinical nursing education evaluation.

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Disclosure statement

The authors declare no conflict of interest.

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