

Students' Learning Effectiveness And Satisfaction In Applying Scaffolding Theory And Cooperative Learning Strategies In Physical Assessment And Practice

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Abstract:

Background: This study examined the impact of scaffolding theory and cooperative learning strategies on nursing students' learning effectiveness and satisfaction in the Physical Assessment and Practice course.

Materials and Methods: This quasi-experimental design was conducted with 42 second-year nursing students at a national university of science and technology in northern Taiwan. The 18-week course was structured into two phases: traditional teaching during the first nine weeks, followed by scaffolding and cooperative learning strategies in the subsequent nine weeks. The interventions included peer collaboration, teaching assistant support, instructor guidance, role-playing, group practice, pre-class quizzes via Zuvio, and the uploading of practice videos to YouTube for guided feedback, self-assessment, and peer review. Post-class discussions were facilitated through i-Class and Line groups.

Results: Learning effectiveness was assessed using written examinations, practical tests, and questionnaires. Students' exam scores, practical performance, and questionnaire results were significantly higher during the scaffolding and cooperative learning phase than during the traditional phase ($p < 0.05$). The average satisfaction score exceeded 4.38, with students emphasizing the benefits of communication scripts, group collaboration, and digital tools.

Conclusion: The integration of scaffolding theory with cooperative learning strategies effectively enhances learning outcomes and satisfaction, offering valuable insights for instructional design in skill-based nursing education.

Keywords: Scaffolding theory; Cooperative learning strategies; Physical assessment; Learning effectiveness; Learning satisfaction.

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I. Introduction

Physical assessment is a core competency in nursing practice and an essential component of nursing education, enabling students to provide safe, effective, and professional patient care.^{1,2,3,4} By integrating theory with practice, nursing education aims to cultivate students' clinical judgment and problem-solving skills, preparing them to manage complex clinical situations.⁵ Most contemporary nursing students belong to Generation Z, whose learning preferences are significantly influenced by the rapid advancements in digital and technological fields. They tend to favor interactive and hands-on learning supported by audiovisual stimulation, instant feedback, and peer engagement, rather than relying solely on traditional lectures and textbooks. However, this generation is generally characterized by shorter attention spans and a desire for immediate responses.^{6,7} Nearly half of Generation Z students report spending at least three hours per day watching YouTube, identifying it as their preferred learning method.⁶

Despite the recognized importance of physical assessment, many nursing students face challenges in this course due to limited clinical experience, insufficient communication skills, low self-efficacy, and the abstract and complex nature of the content.⁸ To address these barriers, effective teaching strategies are needed.

Scaffolding theory provides a structured support system that enables learners to overcome obstacles and progressively achieve higher levels of competence. According to Vygotsky (1978)⁹, learning and development occur within the Zone of Proximal Development (ZPD) through four stages, during which teachers and facilitators play a crucial role. In practice, scaffolding strategies include modeling, feedback, instructing, questioning, and cognitive structuring, which help students transition from assisted learning to autonomous learning, ultimately achieving internalized learning goals.^{9,10} Also applied to nursing education, students can achieve concrete learning effectiveness.^{11,12}

Similarly, cooperative learning is a structured, learner-centered instructional strategy. Through heterogeneous grouping, students engage in collaborative knowledge construction, discussion, and reflection, thereby enhancing critical thinking, professional confidence, and learning outcomes.^{13,14,15} Johnson and Johnson (2018) proposed that successful cooperative learning requires five essential elements: positive interdependence, face-to-face interaction, individual accountability, social skills, and group processing. Implementation typically involves whole-class instruction, group discussions, learning assessments with immediate feedback, and reflection and analysis.¹⁶

In summary, both scaffolding theory and cooperative learning strategies emphasize learner-centered approaches, providing structured support and interactive engagement that effectively enhance students' motivation and professional competence. Therefore, the present study aims to examine the impact of applying scaffolding theory and cooperative learning strategies in the *Physical Assessment and Practice* course on nursing students' learning effectiveness and satisfaction in northern Taiwan.

II. Material And Methods

This study adopted a quasi-experimental, single-group pretest–posttest design. The intervention was implemented over an 18-week course, divided into two phases: traditional teaching during the first nine weeks and the application of scaffolding theory combined with cooperative learning strategies during the subsequent nine weeks. The study period was from September 2024 to January 2025. The study participants were 42 second-year nursing students enrolled in a four-year technical program at a national university of technology in Taiwan.

Study Design: Quasi-experimental, single-group pretest–posttest design.

Study Location: This was a national university of science and technology in northern Taiwan.

Study Duration: September 2024 to January 2025.

Sample size: 42 nursing students.

Sample size calculation: This study employed a single-group pretest-posttest design. Participants were 42 second-year nursing students enrolled in a single class at a national university of science and technology in northern Taiwan. As the study was conducted within a teaching context, the actual class size determined the sample size, and no a priori sample size calculation was performed. The class size was deemed sufficient to examine the effects of the instructional intervention based on similar educational studies in the literature.

Inclusion criteria:

1. Sophomore nursing students in the four-year technical program.
2. Completion of prerequisite courses in Anatomy and Experiments, Physiology and Experiments, Microbiology, Immunology, and Laboratory.
3. No prior experience in hospital internships or nursing employment.
4. Willingness to provide informed consent.

Exclusion criteria:

1. Prior completion of a Physical Assessment course.
2. Failure to complete prerequisite courses in Anatomy and Experiments, Physiology and Experiments, Microbiology, Immunology, and Laboratory.

Data collection tools

Data were collected using a structured questionnaire and additional assessments, which included:

1. Personal demographic information: included age, gender, prior learning experience, admission pathway, and daily study hours.
2. Learning effectiveness evaluation:
 - (1) Learning Effectiveness Questionnaire: Developed by the researcher based on teaching experience, course content, and relevant literature.¹⁷ The instrument consists of 16 items scored on a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree), with total scores ranging from 16 to 80. Higher scores indicate greater self-perceived learning effectiveness.
 - (2) Course grade: Comprised of midterm and final written exams, midterm and final skill assessments, and course participation.
 - (3) Midterm grade: Sum of the midterm written exam and midterm skill assessment.
 - (4) Final grade: Sum of the final written exam and final skill assessment.

3. Learning Satisfaction Questionnaire: Developed by the researcher based on teaching experience, course content, and relevant literature ¹⁷, with reference to the course satisfaction survey from National Taipei University of Nursing and Health Sciences. The questionnaire consists of 11 items scored on a 5-point Likert scale (1 = very dissatisfied to 5 = very satisfied). Higher scores indicate greater satisfaction with the learning experience.
4. Formative assessment: Students' self-assessment of their learning and practice in physical assessment, including their perceived easiest and most difficult aspects, supplemented with qualitative data.

Procedure

The study was conducted in six stages:

1. Stage 1: Development of five scenario scripts and recruitment of teaching assistants (5 second-year nursing students from the two-year technical program) for role-play and assessment.
2. Stage 2: Standardized training for history-taking based on the scenario scripts.
3. Stage 3: Orientation and pretest: Before the start of the course, students were introduced to the course objectives, guidelines, syllabus, schedule, grading criteria, and course procedures, followed by the pretest.
4. Stage 4: Traditional teaching method prior to the midterm exam.
5. Stage 5: Implementation of scaffolding theory and cooperative learning strategies after the midterm exam.
6. Stage 6: Post-course evaluation and posttest.

Statistical analysis

Statistical analysis was performed using the IBM SPSS Statistics software package (version 29.0), with a significance level of 0.05 for all hypothesis tests. Descriptive statistics were performed on the participants' demographics, and the assessment scale scores were expressed as the number of cases, percentage, mean, standard deviation, maximum value, and minimum value. Paired t-tests were also performed to examine the difference between the pre-test and post-test scores.

Ethical Considerations

This study was reviewed and approved by the Institutional Review Board (IRB). Prior to participation, all students were informed about the study's purpose, procedures, potential risks, and benefits. Written informed consent was obtained from all participants, and their confidentiality and anonymity were ensured throughout the study. Participation was voluntary, and students were free to withdraw from the study at any time without academic penalty.

III. Result

A total of 42 nursing students were enrolled as participants from September 7, 2024, to January 17, 2025. During the study period, all participants completed the study and were included in the subsequent analyses, resulting in an attrition rate of 0%.

Table 1 shows the demographic characteristics data. A total of 42 nursing students participated in the study, with the majority being female ($n = 34$, 81.0%). Participants had a mean age of 20.55 years ($SD = 0.80$). Regarding academic performance, more than half of the students ($n = 22$, 52.4%) reported having failed one or more courses since entering university. In terms of admission pathways, most students were admitted through the General Scholastic Ability Test (GSAT) ($n = 27$, 64.3%). On average, participants reported studying 2.89 hours per day ($SD = 1.84$).

Table 1. Distribution of Basic Demographic Characteristics of Nursing Students ($N = 42$)

Variables	n	%	Mean $\pm$ SD	Min	Max
Sex					
Female	8	19.0			
Male	34	81.0			
Age			20.55 $\pm$ 0.80	20	24
20 years	24	57.1			
21 years	15	35.7			
≥ 22 years	3	7.2			
Failed courses in university				0	3
None	16	38.1			
1 course	22	52.4			
2 courses	3	7.1			
3 courses	1	2.4			
Admission pathway					
GSAT	27	64.3			

JCEE	15	35.7			
Daily study hours			2.89 ± 1.84	0	8
0	2	4.8			
0.5-3.0	24	57.1			
3.5-6.0	14	33.3			

Note: GSAT= General Scholastic Ability Test; JCEE = Joint College Entrance Examination for Technological and Vocational Education

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Table 2 compares the between-group differences in traditional teaching and a combination of scaffolding theory and cooperative learning. Regarding the overall score of learning effectiveness, students in the traditional teaching approach achieved a mean score of 63.00 ($SD = 10.16$). In contrast, those instructed through a combination of scaffolding theory and cooperative learning achieved a higher mean score of 67.49 ($SD = 9.40$). The results of the paired samples t-test showed that the difference between the two approaches was statistically significant ($p < .001$). Significant differences were also observed across most individual items, indicating that the scaffolding and cooperative learning approach yielded superior learning outcomes compared to traditional instruction. The only exceptions were Item 7 ("This course has enhanced my ability to participate in communication and discussion."), Item 8 ("This course has enhanced my ability to collaborate effectively in a team setting."), Moreover, Item 16 ("Overall, this course is worthwhile and meaningful."). These findings suggest that, regardless of the instructional approach, students consistently achieved learning outcomes related to communication, discussion, and teamwork, and generally agreed that the course was worthwhile.

Regarding semester performance, the average score for the midterm practical examination was 80.9, while the midterm written examination yielded an average score of 64.7. The average score for the final practical examination was 87.1, whereas the final written examination averaged 63.5. The overall semester mean was 77.3. Notably, the final practical examination scores were substantially higher than those of the midterm practical examination. Furthermore, all results met the predetermined benchmark that the overall class average should exceed 70 points.

Table 2. Comparison of Total and Item Scores on the Learning Effectiveness Scale Between Traditional and Scaffolding Teaching Approaches in Nursing Students

No.	Items	Traditional teaching (M±SD)	Scaffolding teaching (M±SD)	t	P
1	I can recall the professional knowledge acquired in this course.	3.81±0.74	4.10±0.66	2.75	.009**
2	I can comprehend the professional knowledge acquired in this course.	3.98±0.72	4.29±0.67	3.11	.003**
3	I can analyze the professional knowledge acquired in this course.	3.74±0.77	4.07±0.75	3.53	.001**
4	I can apply the professional knowledge acquired in this course to practical contexts.	3.90±0.69	4.26±0.70	3.53	.001**
5	I can engage in critical thinking based on the professional knowledge acquired in this course.	3.69±0.75	4.02±0.81	3.79	<.001***
6	I can engage in creative thinking based on the professional knowledge acquired in this course.	3.43±0.83	3.86±0.90	4.41	<.001***
7	This course has enhanced my ability to participate in communication and discussion.	4.40±0.70	4.52±0.71	1.15	.256
8	This course has enhanced my ability to collaborate effectively in a team setting.	4.42±0.67	4.60±0.66	1.74	.090
9	This course has strengthened my ability to integrate theory with practice.	4.10±0.76	4.33±0.69	2.23	.031*
10	This course has enhanced my problem-solving skills.	3.98±0.84	4.21±0.78	2.35	.023*
11	Learning in this course has sparked my interest in pursuing further education.	3.62±0.99	4.02±0.87	3.57	<.001***
12	The design of this course has provided me with substantial benefits.	4.05±0.79	4.38±0.70	2.86	.007**
13	The learning outcomes of this course hold significant value for me	3.97±0.84	4.33±0.75	3.05	.004**
14	This course has increased my interest in pursuing related courses and knowledge.	3.76±0.88	4.10±0.91	3.15	.003**
15	I am willing to recommend this course to others.	3.90±0.88	4.19±0.71	3.34	.002**
16	Overall, this course is worthwhile and meaningful.	4.24±0.69	4.40±0.63	1.64	.109
	Overall score	63.00±10.16	67.49±9.40	4.67	<.001***

Note: Scores are presented as mean (M) ± standard deviation (SD); * $p < .05$, ** $p < .01$, *** $p < .001$

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Tables 3 and 4 show the learning satisfaction of nursing students, comparing the between-group differences in traditional teaching and a combination of scaffolding theory and cooperative learning. In terms of learning satisfaction, the traditional teaching method had a mean score of 3.90 points ($SD = 0.82$), while the scaffolding theory and cooperative learning method had a mean score of 4.31 points ($SD = 0.68$). The comparison between the two was significant ($p < .001$); this means that the learning satisfaction associated with scaffolding theory and cooperative learning teaching was better than that of traditional teaching. Among the learning satisfaction questions, the top three highest-scoring items were: Item 9 "2-7. The guidance provided by teaching assistants and senior students has positively contributed to my learning.", with a score of 4.76 points ($SD=0.48$); followed by Item 4 "2-2. The scenario-based history-taking scripts have strengthened my communication skills.", with a score of 4.67 points ($SD=0.65$); and the third highest-scoring item was Item 8 "2-6. The demonstration videos have been effective in helping me master physical assessment techniques. ", with a score of 4.64 points ($SD=0.66$). Among the questions on learning satisfaction, the lowest score was in Item 1, " I am satisfied with the instructional design of the traditional teaching approach in this course. " It scored 3.90 ($SD = 0.82$).

The overall average learning satisfaction score was 4.38 ($SD = 0.63$). This result confirms that incorporating scaffolding theory and collaborative learning teaching strategies into course design can achieve the expected learning satisfaction.

Table 3. Comparison of Learning Satisfaction Between Traditional and Scaffolding Teaching Approaches Among Nursing Students

Items	Traditional teaching (M±SD)	Scaffolding teaching (M±SD)	<i>t</i>	<i>P</i>
I am satisfied with the instructional design course.	3.90±0.82	4.31±0.68	-3.75	<.001***

Note: * $p < .05$, ** $p < .01$, *** $p < .001$

Table 4. Mean Scores and Rankings of Learning Satisfaction Among Nursing Students

No.	Items	M±SD	Range	Rank
1	1. I am satisfied with the instructional design of the traditional teaching approach in this course.	3.90±0.82	2-5	11
2	2. I am satisfied with the instructional design of the scaffolding and cooperative learning approach in this course.	4.31±0.68	3-5	8
3	2-1. The design of the course content has effectively supported my learning.	4.35±0.62	3-5	6
4	2-2. The scenario-based history-taking scripts have strengthened my communication skills.	4.67±0.65	3-5	2
5	2-3. Practicing communication with peers has further enhanced my skills in this area.	4.54±0.77	3-5	4
6	2-4. The resources provided through the i-Class system, including the discussion forum, have facilitated my learning.	4.54±0.67	2-5	4
7	2-5. The practice activities using Zuvio IRS have reinforced my understanding of theoretical knowledge related to physical assessment systems.	4.33±0.72	2-5	7
8	2-6. The demonstration videos have been effective in helping me master physical assessment techniques.	4.64±0.66	2-5	3
9	2-7. The guidance provided by teaching assistants and senior students has positively contributed to my learning.	4.76±0.48	3-5	1
10	3. This course has increased my confidence in performing physical assessment techniques.	4.07±0.78	3-5	9
11	4. Overall, I am satisfied with my learning experience in this course.	4.00±0.82	3-5	10
	Overall average	4.38±0.63	2-5	

Note: Scores are presented as mean (M) ± standard deviation (SD); * $p < .05$, ** $p < .01$, *** $p < .001$

Qualitative Data Analysis (From the Formative Assessment of Student Learning Feedback)

Based on student feedback, several key themes emerged:

1. Teaching Methods and Course Design

Students generally valued the instructor's approach of beginning each lesson with theoretical foundations, which facilitated knowledge review and strengthened comprehension. One student remarked, "The teacher always starts with essential knowledge, which I think is great. If I had forgotten the basics and did not review them first, I would not have understood the later parts at all." Another emphasized the practical value of

the course: *"Thank you, teacher, for giving us such a fulfilling semester. I have learned so much and will definitely apply what I have learned in this course to clinical practice in the future."*

2.Digital Materials and Teaching Resources

Recorded demonstration videos and digital learning materials were highly appreciated for their utility in previewing, reviewing, and practicing. As one student noted, *"Recording the demonstrations into videos was extremely useful. Before exams, I could watch them repeatedly to practice—very practical."* Another added, *"The digital materials allowed us to preview, and the in-class explanations helped me better understand the details of the movements. During group practice, we could also discuss problems together."*

3.Peer and Teaching Assistant Support

Teaching assistants, who were senior students, were praised for their clear explanations of theoretical concepts and patient guidance, which greatly supported the learning process. Students also highlighted the benefits of peer collaboration and small-group practice in refining technical skills: *"We borrowed the practice room many times, and through repeated hands-on practice, I was able to understand palpation and inspection techniques better, and gradually became more skilled."*

4.Learning Experience

Most students described the physical assessment course as engaging, as it encouraged them to observe bodily details often overlooked. Some, however, admitted to feeling nervous during examinations. Others expressed gratitude that the course design provided their class with more resources and opportunities compared to other classes, which enhanced their sense of accomplishment.

5. Suggestions for Improvement

One student voiced concern about the stress associated with group-based grading and suggested adopting individualized assessment: *"It is really exhausting. Please cancel this system—everyone should be responsible for their own grades without bearing the consequences of others' performance."*

IV. Discussion And Conclusion

This study demonstrated that integrating scaffolding instruction and cooperative learning strategies into a physical assessment and practice course significantly improved nursing students' learning effectiveness and satisfaction compared with traditional teaching. The results are consistent with prior studies, which indicate that scaffolding facilitates learners' progression from theoretical knowledge to practical application, while cooperative learning fosters peer interaction and skill consolidation.^{11,12,13,14,15}

Quantitative results showed that students in the scaffolding and cooperative learning approach achieved higher overall learning scores, and their final practical examination results improved compared to their midterm performance, underscoring the sustained impact of this approach on clinical competence. These findings align with previous evidence that structured, student-centered pedagogies enhance both knowledge retention and clinical performance.^{11,12} Although no significant differences were observed in communication and teamwork items, both approaches reported strong performance in these domains, suggesting that the course design already supports these skills.

Learning satisfaction was also significantly higher in the scaffolding and cooperative learning approach. Qualitative feedback provided further insights: students valued theoretical introductions, demonstration videos, and digital resources that enhanced their preparation and review. Meanwhile, peer collaboration and guidance from teaching assistants were seen as crucial supports. Similar findings have been reported in studies highlighting the value of digital learning tools and peer-assisted instruction in nursing education. However, some students expressed stress related to group grading, indicating the need to balance collaborative learning with fair and motivating assessment strategies. This challenge has also been documented in other cooperative learning contexts, where group-based evaluation can inadvertently heighten stress and reduce motivation.¹⁸

Taken together, the findings indicate that integrating scaffolding and cooperative learning strategies can effectively enhance nursing education by improving both academic performance and experiential learning outcomes. Nevertheless, ongoing refinement of course design is warranted, particularly to address student stress and to optimize evaluation methods.

V. Limitations And Recommendations

This study examines the effectiveness of teaching and teaching satisfaction achieved by employing two teaching strategies in a single class. In future courses, the following suggestions are made:

1.Course Design: Continue adopting scaffolding and cooperative learning approaches, beginning with foundational theory and progressing to structured practice.

- 2. Digital Resources:** Provide demonstration videos and online materials to strengthen pre-class preparation and post-class review.
- 3. Support Systems:** Utilize teaching assistants and peer collaboration, while promoting cross-group interaction to expand learning opportunities and enhance student engagement.
- 4. Assessment:** Employ a blended model that combines group-based and individual evaluation to reduce stress while preserving the benefits of teamwork.
- 5. Stress Management:** Incorporate strategies to improve coping and self-efficacy during clinical practice sessions.
- 6. Future Research:** Expand studies to larger and more diverse student populations using randomized designs, and investigate the effects across various nursing curricula and clinical contexts.

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