Original Article

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Roles of Two Learning Methods in the Perceived Competence of Surgery and Quality of Teaching: A Quasi-experimental Study among Operating Room Nursing Students

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Abstract

Introduction: Nowadays, Clinical courses are meticulously structured to give students essential opportunities to elevate their professional qualifications, so that the patients' safety is protected and their conditions improve. Given the many challenges in the clinical environment of the operating room, this study was conducted to compare the impact of team-based and task-based learning methods in the clinical settings on the perceived competence of surgery and the quality of training from the operating room nursing students' point of view.

Methods: This quasi-experimental study was conducted on fifty 5th semester operating room technology students at Hamadan University of Medical Sciences in 2023. In this study, students were selected using the convenience sampling method and placed in two educational groups (team-based and task-based) of 25 subjects using the matching method. After implementing the training process in the operating room setting, the data related to the study were collected using the valid questionnaires of perceived competence in surgery (Cronbach's alpha=0.86) and quality of education (Cronbach's alpha=0.94). Also, the data analysis was conducted at the descriptive and inferential (included independent t-test and analysis of covariance) statistics level using SPSS version 16 software.

Results: Findings showed that the mean clinical training quality score was significantly higher in the team-based learning group than in the other group (P=0.014). Also, after the median intervention, the perceived competence score of surgery was higher in the task-based learning group than in the team-based group, and the difference in the average change of the competence score between the two groups was statistically significant (P<0.001).

Conclusion: Based on the results, it is suggested that a task-based learning method should be used for the clinical instructors to increase level of the perceived competence of the surgery among operating room nursing students.

Keywords: Clinical competence, Teaching methods, Learning, Operating room

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Introduction

Nowadays, one of the desirable methods of learning in medical sciences is the learning skills in a clinical environment (1). Clinical education is crucial as it helps students apply theoretical knowledge to develop skills necessary for patient care (2).

The operating room environment, considered as the specialized clinical environment of operating room nursing students, always entails many challenges due to crowding, the variety of surgical operations with the presence of surgical and anesthesia groups, etc. In this environment, opportunities are provided for effective training and patient safety (3, 4). On the other hand, since the operating room is a high-risk patient environment, effective training and creation of clinical competence through clinical training are essential for operating room nursing students (5). Therefore, Clinical courses should be meticulously structured to give students essential opportunities to elevate their professional qualifications. Clinical educators play a major role in achieving this goal by choosing the correct educational method (6).

Regarding different educational methods, educational psychologists believe learning is improved with more inclusive participation in the learning process, and its impact is more lasting. Therefore, experts emphasize the use of new student-centered methods (7). Accordingly, the World Health Organization (WHO), in its statement on clinical educators, recommends using active learning in the education process, choosing appropriate technologies and information, and encouraging students to learn experientially (8). In this regard, some previous studies have considered team-based and task-based learning methods as two student-oriented methods to increase clinical skills and their function (6, 9).

The team-based learning method is an active and student-centered educational strategy that allows students to apply conceptual knowledge in small groups (10). This educational method is presented to improve the quality of students' learning through increasing problem-solving skills (11). In this new method, students conduct various discussions around the educational goals the teacher sets, which ultimately increases their motivation, understanding, and mastery of the knowledge they have learned (12). This educational method generally consists of three stages: studying the basic material independently by the students, assessing the basic understanding of the concepts by conducting an individual and group test to ensure readiness, and performing group activities as assignments (13). Using this method in the field of clinical education can play a significant role in improving the students' clinical reasoning ability (14, 15). Also, the results of previous studies show that the use of team-based learning methods and teamwork is effective in creating interaction between students, solving problems related to different views about a patient, and facilitating the application of theoretical knowledge in the clinical environment by the instructor (9). On the other hand, one of the problems of inexperienced surgical technologists is the lack of the necessary skills due to fears that remain from their studentship period (16). Various studies show that participation in team work is an effective factor for students to overcome their fear and acquire the relevant qualifications to work in their desired profession (17). In spite of the advantages of this educational method, previous studies have criticized the lack of sufficient motivation and sufficient ability in students to solve clinical problems. However, the team-based learning method plays a significant role in reducing the students' stress through participation in group activities and fairer assessment (15).

Task-based learning is one of the modern educational methods that is very popular today to achieve satisfactory clinical performance for students (6). In this educational method, the educational goals are set by the instructor based on the tasks of the health team, and learning is achieved by performing the tasks by the students in the clinical environment (18). In this method, the learning process consists of three main stages. At the beginning, the environment and requirements for learning are provided. Then, various tasks are assigned to the student in line with the educational goals, and the instructor follows up and evaluates the student's performance. Finally, in the case of need, training can be repeated (19). In applying different training and learning rules, the student works as a part of an organization and is asked to apply his knowledge and clinical skills in different situations and acquire the required professional competence (20). This active educational method increases the students' motivation, encourages them to learn, and plays a major role in the quality of education, providing sufficient experience for students (21, 22).

Given that the operating room students, based on their clinical nature, should be trained in the clinical environment and the necessity to use appropriate teaching techniques to increase their competence and motivation level for learning, and as no study has compared the effects of team-based and task-based learning methods on

operating room nursing students, the question arises as to enhance operating room nursing students' perceived competence of surgery and clinical training quality, which method is more effective: team-based or task-based learning?

Methods

Study Design and Participants

This quasi-experimental study was conducted at Hamadan University of Medical Sciences in 2023. In this study, the statistical population included the Hamadan University of Medical Sciences operating room technology students, among whom 50 students were selected using the convenience sampling method and based on the inclusion criteria. As to the sample size, according to the results of Mirbagher Ajorpaz et al.'s study (23), the mean and standard deviation of Perceived Competence in the intervention group before and after were equal to 38.23 (2.59) and 46.84 (1.91), respectively, and in the control group, respectively, equal to 38.69 (2.54) and 42.59 (2.39) were considered. Considering the type I error equal fo 0.05 (α=0.05) and power of 0.90 (1-β=0.90), the minimum sample size was 7 samples in each group. For increasing the reliability of the study and by predicting a possible sample loss and increasing the power of the statistical tests, 25 students was allocated to each group. The following equation was used to calculate the sample size.

$$n = \frac{\left(Z_{1-\frac{\alpha}{2}} + Z_{1-\beta}\right)^2 \left(S_1^2 + S_2^2\right)}{d^2}$$

Also, the inclusion criteria for this research were students studying in the 5th semester of operating room technology and willingness to participate in the study. Also, the only exclusion criterion for this study was absence in more than 2 training sessions.

Ethical Considerations

The study was approved by the Ethics Committee of Hamadan University of Medical Sciences with the code of IR.UMSHA.REC.1402.493. All participants were informed about the aim of the study and informed consent to conduct the research was obtained from them. Also, the research units were assured of the confidentiality of the information.

Data Collection

In this research, 3 questionnaires were used to collect the data:

1- Demographic information questionnaire included age, gender, marital status, student's grade point average (GPA), academic semester, and the number of credits passed by the student.

2- The Persian and revised version of the perceived surgical competency questionnaire measured the students' perceived competence in surgery. This questionnaire was first designed by Glipsey and Hamilton in Australia in 2009 with 8 subscales and 98 statements for final-year students and experts. This instrument was revised by Glipsey et al. in 2012 and named the Revised Scale of Perceived Competence in the Operating Room. It has 40 items and 6 subscales, including foundational skills and knowledge (9 items), leadership (8 items), collegiality (6 items), proficiency and expertise (6 items), empathy (5 items), and professional development (6 items). The reliability of this scale was determined using Cronbach's alpha coefficient of 0.96 in the whole scale and between 0.81 and 0.89 for the subscales (24). In Iran, the scale was translated for the first time, and its psychometric properties were assessed by Mirbaqer Ajorpaz et al. among internship students of medical sciences universities. The congruence or internal consistency of the instrument was evaluated using Cronbach's alpha. The results of face validity, content (0.95 in relevance dimension), structure (confirmatory and exploratory factor analysis), and scale reliability (0.86) showed that the PPCS-R (Perceived Perioperative Competence ScaleRevised) six-factor scale is in the localization phase in the country with 33 items and 5 subscales including foundational skills and knowledge (7 items), leadership (9 items), collegiality (7 items), proficiency (4 items), and professional development (6 items); it has adequate validity and reliability. The obtained version was adjusted like the original version of the instrument with a 5-point Likert scale with the range of never [1], rarely [2], sometimes [3], often [4], and always [5]. The score of this tool is reported quantitatively, and the total score range of the Persian version is from 33 to 163; also, higher scores indicate greater competence (23, 25).

3- The questionnaire designed by Bahadori et al. is used to evaluate the quality of education. This questionnaire, with 28 items and four subscales, includes educational objectives and programs (11 items), the instructor's performance (9 items), interaction with students (4 items), and monitoring and assessment (4 items). The reliability of the instrument was also assessed through the test–retest approach with a correlation coefficient of 0.92 and a Cronbach's alpha of 0.94 (6). In this questionnaire, each question is

examined with a nominal scale of Yes, Somewhat, and No. The answer "Yes" is considered a favorable situation and indicated by a score of 3, the answer "Somewhat" is considered a relatively favorable situation and indicated by a score of 2, and the answer "No" is considered an unfavorable situation and indicated by a score of 1.

It should be mentioned that the perceived surgical competency questionnaire was distributed twice. It was distributed among the students in the first training session to check the perceived surgical competence of the students before starting the training. Also, once again, this questionnaire was given to the students to complete along with the education quality questionnaire in the last training session of both groups. Also, the clinical education quality questionnaire was distributed themthe once and after completing the training course.

Intervention

To conduct the study and collect data, we placed the students in 2 task-based and team-based learning groups using matching method; the number of students in each group was 25 (Figure 1).

An instructor held the training sessions for both groups in 2 different periods and 18 sessions that lasted five hours in the operating room department of Besat Hospital, Hamadan.

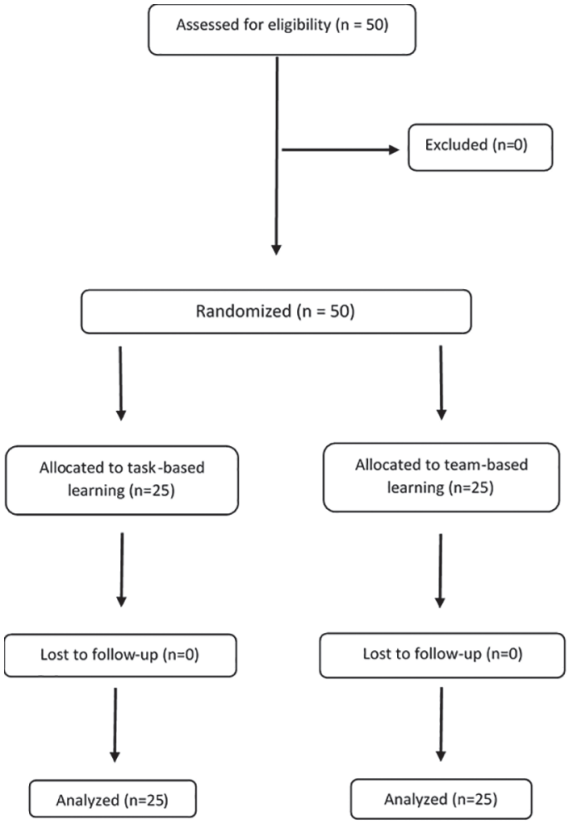

Figure 1: Participant Flow

In this study, the students had passed the Operating Room Technique 2 Internship course. According to the educational curriculum in this course, the students, under the direct supervision of the instructor, not only performed scrub and circular tasks in the fields of general and specialized surgery (orthopedic, thoracic, neurology) accurately but also they were responsible for explaining the types of incisions and how to close the wound. Also, students apply theoretical and practical knowledge in cases such as the anatomy of the surgical site (anatomy of different parts of the body, tissue layers, etc.), types of surgical incisions and tools and equipment related to exposure and suture (dissection of layers, hemostasis, wound dressing) and acquire the necessary skills. In the task-based learning group at the beginning of each training session, the specific tasks of students in the fields of principles and techniques of circular and scrub, surgical techniques, and surgical tools and equipment in the conference hall of the operating room department were taught in a theoretical and practical manner (18). Finally, they were asked to work in the main surgery rooms like the operating room personnel and to be effective in the performing surgical procedures of the surgical team members. The instructor followed up the performance of the above tasks, and if necessary, the student was retrained to perform a specific activity correctly.

In the team-based learning group, the students were required to review the relevant and specified materials in three areas of principles and techniques of the circular person and scrub, surgical techniques, and surgical tools and equipment before starting each internship session. At the beginning of each training session and in the conference hall of the operating room department, an individual test was conducted for 10 minutes on the specified materials. After collecting the individual test, a team test with similar concepts to the first test was held for 20 minutes.

After collecting the questions, the groups discussed and reviewed the test questions for 30 minutes with the instructor's guidance and feedback. Finally, after their allocation to the operation rooms, the students performed the designated activities related to the topic and objectives of the meeting with the supervision and cooperation of their fellow students and tried to criticize the work of their fellow students. Also, to motivate the students, they were evaluated based on team and individual activities at the end of each session, and the teams were ranked (26).

Statistical Analysis

Finally, data analysis was conducted using SPSS, version 16.0 (SPSS Inc., Chicago, Ill., USA) software at a significance level 0.05. At first, the assumption of normality of the data was checked using the Kolmogorov-Smirnov and Shapiro-Wilk tests. Descriptive statistics included determining frequency, frequency percentage, mean, and standard deviation. Chi-square tests (or Fisher's exact test if needed) and independent t-tests were used to compare the frequency distribution of qualitative and quantitative demographic characteristics between the two groups. In addition, scores between the two groups before and after the intervention and within each group were compared using Independent t-test and paired t-test, respectively. In comparing the perceived competence scores between the two groups after the intervention, covariance analysis was used to control the scores before the intervention.

Results

In this study, 50 undergraduate students of operating room technology were studied in two task-based and team-based learning groups. The Mean±Standard Deviation of the age of the students was 22.56±1.28 years. 94% (n=47) of the students were single, and 6% (n=3) were married. 44% (22 people) of the students were male, and 56% (28) were female. In terms of gender distribution, marital status, mean age, and grade point average (GPA) of students, there was no statistically significant difference between the two groups (Table 1).

Based on the findings of our study, the mean±standard deviation of the total clinical training quality score in the task-based and team-based learning groups was equal to 71.32±6.50 and 76.72±8.36, respectively, and this difference was statistically significant based on independent t-test (P=0.014). Table 2 shows the mean and standard deviation of the clinical education quality score between the two study groups.

Also, Table 3 shows the mean and standard deviation of the clinical education quality subscales.

Based on the results of Table 4, there was a statistically significant relationship between the scores of the goals and educational program and interaction with students between the two groups (P<0.05). Thus, the mean score of these subscales in the team-based learning group was higher than the task-based learning group. Moreover, there was no statistically significant relationship between the mean score of the coach and monitoring and evaluation between the two groups.

Findings showed that before the intervention, the student's competency score in the team-based learning group was higher than the task-based learning group. Still, based on the independent t-test, this difference was not statistically significant (P=0.34).

Table 1: Student's demographic characteristics by study groups

		Team-based learning	Task-based learning	P
Age		22.72±1.33	22.40±1.22	0.382
Grade point average		17.55±0.58	17.39±0.64	0.364
Marital status	Single	92% (n=23)	96% (n=24)	0.99
	Married	8% (n=2)	4% (n=1)	
Gender	Male	44% (n=11)	44% (n=11)	0.99
	Female	56% (n=14)	56% (n=14)	

Table 2: Comparison of the mean score of clinical education quality after the intervention by the study groups

Group	Mean±SD	P
Task-based learning	71.32±6.50	0.014
Team-based learning	76.72±8.36	

Table 3: Comparison of the mean scores of clinical education quality subscales after the intervention by the study groups

Subscale	Group	Mean±SD	P
Educational objectives and programs	Task-based learning	27.08±3.30	0.022
	Team-based learning	29.04±2.47	
Instructor's performance	Task-based learning	24.28±2.23	0.156
	Team-based learning	26.24±6.43	
Attitudes and behavior toward students	Task-based learning	9.44±1.61	0.016
	Team-based learning	10.44±1.19	
Monitoring and assessment	Task-based learning	10.52±1.50	0.173
	Team-based learning	11.00±0.87	

Table 4: Comparison of the mean total score of perceived competence of surgery before intervention by the study groups

Group	Number	Mean±SD	P
Task-based learning	25	85.64±9.21	0.34
Team-based learning	25	88.76±13.43	

Table 5: Comparison of the mean scores of perceived competence of surgery, before and after the intervention by the study groups

Subscale	Group	Number	Mean±SD	P*
Before intervention	Task-based learning	25	85.64±9.21	<0.001
	Team-based learning	25	88.76±13.43	
After intervention	Task-based learning	25	125.08±14.82	
	Team-based learning	25	111.36±12.14	

*P value based on Ancova

Table 6: Comparison of the mean scores of perceived competence of surgery subscales, before and after intervention by the study groups

Subscale		Task-based learning	Team-based learning	P	P (ANCOVA)
Foundational skills and knowledge	Pre	16.00±2.65	17.84±3.70	0.05	0.001
	Post	24.96±4.02	21.56±3.54	0.003	
	Change	8.96±5.87	3.72±1.86		
	P	<0.001	<0.001		
Leadership	Pre	22.20±4.24	23.76±4.39	0.208	0.001
	Post	34.16±4.62	29.92±4.17	0.001	
	Change	11.96±6.74	6.16±4.05		
	P	<0.001	<0.001		
Collegiality	Pre	17.76±2.82	19.20±3.00	0.087	<0.001
	Post	28.00±3.21	24.40±2.55	<0.001	
	Change	10.24±4.30	5.20±2.36		
	P	<0.001	<0.001		
Proficiency	Pre	11.68±2.58	11.68±2.34	0.999	0.218
	Post	14.84±2.61	13.96±2.34	0.215	
	Change	3.16±4.43	2.28±2.68		
	P	0.002	<0.001		
Professional development	Pre	18.00±5.78	16.28±3.36	0.275	0.275
	Post	23.12±4.53	21.52±3.81	0.183	
	Change	5.12±7.39	5.24±3.25		
	P	0.002	<0.001		

Table 3 shows the mean and standard deviation of the total score of perceived surgical competence between the two study groups before the intervention.

Table 5 shows the mean competency score between the two groups before and after the intervention, along with the results of covariance analysis. Based on the results of the analysis of covariance, the main effect of the perceived competence score of surgery before the intervention was not significant between the two groups ($F_{(1,46)}$=1.749 , P=0.193). Also, the interaction effect of competence score before the intervention and group was not statistically significant ($F_{(1,46)}$=3.198 , P=0.081).

According to Table 5, after the intervention, the mean score of perceived competence of surgery in the task-based group was higher than the team-based group, which was statistically significant based on the analysis of covariance. (P<0.001) Also, based on the independent t-test results before the intervention, there was no statistically significant difference between the mean competency subscales before the intervention.

Table 6 shows the mean and standard deviation of the scores of different competence subscales in the studied subjects before and after the intervention. After the intervention, the mean score of basic knowledge and skills, leadership, collegiality, skills, and personal development in the task-based group was higher than the team-based learning group. Based on the results of covariance analysis, considering the scores before the intervention as a covariate, the mean changes in the scores of knowledge

and basic skills, leadership, collaboration, and communication between the two groups were statistically significant (P<0.05).

Discussion

In this study, team-based and task-based learning methods were used in the operating room nursing students internship, and their effect was measured by comparing the perceived surgical competence scores and the quality of education. The results showed that from the student's point of view, the team-based learning method had a higher quality than the task-based learning method. In Mohebi et al.'s study, students were more satisfied with the team-based learning method than the traditional educational methods (27). Also, in Gera et al's study, students stated that the team-based learning method was more interesting than the problem-based learning method; they generally reported higher satisfaction with this new method (15). Considering that the team-based learning method provides an active learning environment for students in which the students are more connected than the task-based learning method, and the tasks are performed in groups, the high quality of education in this method seems logical from the students' point of view.

Also, based on the results of this study, among the different subscales of education quality, in the subscales of goals and educational programs as well as the subscale of attitudes and behavior toward students, the scores recorded in the team-based group were significantly higher than the task-based group; this can be justified by facilitating the achievement of educational goals, increasing interaction between students and instructors, and providing immediate feedback to students by instructors in the team-based educational method (10, 15).

The present study showed that both team-based and task-based learning methods could significantly increase the perceived competence of surgery. In line with this result, in research conducted by Bahadori et al., it was shown that the team-based learning method plays a significant role in increasing the perceived competence of surgery in the operating room students (6). Also, the results of previous studies have shown that the task-based learning method, by teaching the tasks that match their job duties, plays an important role in increasing their clinical competence (20); this is in line with the results of our study. However, the task-based learning method was more effective in increasing the perceived competence of surgery, especially in the subscales of foundational skills and knowledge, leadership, and collegiality, and this difference was statistically significant.

The greater impact of the task-based educational method on the level of competence of students in the mentioned fields can be justified due to the major role of this type of education in communicating between theory and practice, doing tasks and learning independently, and increasing students' communication skills and justifying their interactions (18). Given the activities of students and operating room personnel in an environment where technology and performance are constantly changing, it is very important to acquire the necessary qualifications and skills during the student period (28). Therefore, considering that the lack of clinical skills and competencies in the staff is one of the most important problems in the operating room department (29), which can be the result of students facing clinical stressors during their student days (30), using the mentioned training methods, especially the task-based learning method, can be very effective in this field. Considering the contradiction of the findings in preious studies, researchers are suggested to investigate the effects of each of the above educational methods in different dimensions and areas in their future research to improve their effectiveness in learning, and increasing the students' skills should be considered and used in educational guidelines.

Among the limitations of this study, we can mention the impossibility of blinding, not using a control group due to the limited number of qualified samples, and not holding a pre-test to evaluate the quality of the training course held due to the nature of the questionnaire questions which can only be used after the training course.

Conclusion

According to the results of the present study, it can be stated that both learning methods under investigation, especially the task-based learning method, have an effective role in increasing the level of students' perceived competence in surgery. Therefore, according to the essential need of medical environments, especially the operating room department, for efficient human forces and people who have sufficient clinical competence, using the above methods to train operating room nursing students is recommended to prepare them to work in this sensitive and high-risk environment. Also, considering that the team-based learning method has a higher educational quality from the student's point of view, it is recommended that clinical instructors should use this method to satisfy the students

and, as a result, use their effective activity in the clinical environment.

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Authors' Contribution

All authors contributed to the discussion, read and approved the manuscript and agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated resolved.

Conflict of Interest

The authors declare no conflicts of interest.

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