Original Article

The Effects of Task-based Learning and Mentorship on the Perceived Surgical Competency and Clinical Education Condition of Surgical Technology Students

Hanieh Bahadori, Behzad Imani[1], Meysam Hosseini Amiri[2]

Department of Operating Room, Student Research Committee, Hamadan University of Medical Sciences, [1]Department of Operating Room, Faculty of Para Medicine, Hamadan University of Medical Sciences, Hamadan, [2]Department of Anesthesiology, Faculty of Para Medicine, Qom University of Medical Sciences, Qom, Iran

ORCID:

Hanieh Bahadori: 0000-0002-7032-3660

Behzad Imani: 0000-0002-1544-8196

Meysam Hosseini Amiri: 0000-0002-4061-7983

Abstract

Background: It is important to investigate the effectiveness of various educational methods in different cultural, educational, and clinical contexts. **Objectives:** This study aimed to compare the effects of task-based learning (TBL) and mentorship on clinical perioperative competence and clinical education condition of surgical technology students. **Methods:** A quasi-experimental study was conducted on 50 undergraduate surgical technology students of Hamadan University of Medical Sciences in 2021. Students were selected by the convenience sampling method and were randomized into one of the two groups of TBL or mentorship. Students completed a Perceived Perioperative Competence Scale-Revised questionnaire and a Clinical Education Conditions questionnaire before and after the intervention. Chi-square, independent, and pair samples *t*-tests were used for data analysis. **Results:** The pretest mean scores of perceived clinical competence and clinical education condition were, respectively, 106.56 ± 18.34 and 55.56 ± 9.45 in the TBL group and 99.72 ± 16.08 and 53.64 ± 6.89 in mentorship group. No significant difference was found between the two groups in mean overall clinical competence and mean clinical education condition ($P > 0.05$). After the intervention, the mean scores for perceived clinical competence and clinical education condition increased significantly to 128.92 ± 12.49 and 69.80 ± 6.38 in the TBL group ($P < 0.001$) and 120.24 ± 16.75 and 69.04 ± 7.23 in the mentorship group ($P < 0.001$). The posttest mean score of perceived clinical competence was significantly greater in the TBL group than in the mentorship group ($P < 0.001$). **Conclusions:** Both the TBL and mentorship methods are effective in improving the clinical competence and clinical education condition of undergraduate surgical technology students.

Keywords: *Competence, Mentor, Operating rooms, Perioperative, Task-based learning*

Introduction

Clinical education is one of the most significant pillars in improving the operating room skills of surgical technology students.[1,2] More than half of the surgical technology courses are dedicated to clinical education.[3,4] Some recent studies show that the quality of clinical education in the surgical technology program is unsatisfactory and that graduates of this program do not have the required competence.[5-9] Surgical technology students must learn a vast number of procedures and skills related to pre-, peri-, and post-operative phases. This makes it challenging for them to learn the essential skills and tasks.[10] Furthermore, inconsistency between theoretical courses and clinical duties, unclear

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Address for correspondence: Dr. Behzad Imani, Department of Operating Room, Faculty of Para Medicine, Hamadan University of Medical Sciences, Hamadan, Iran. E-mail: behzadiman@yahoo.com

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educational objectives, stressful operating room environment, low desire of experienced instructors for clinical training, lack of bonding between instructors and students, and rapidly transforming therapeutic methods make clinical training even more challenging for students.[2,11,12] Because experienced personnel is needed to work in the operating room, clinical courses should provide students with the necessary opportunities to acquire professional competency.[3,8,13] Therefore, clinical instructors play a critical role in the success of clinical education, and in linking theoretical courses to clinical practice. Clinical instructors usually seek teaching methods that can appropriately boost students' clinical knowledge and skills.[5,14] Task-based education is one of the novel educational approaches that aim to achieve a satisfactory level of performance in clinical practice. This method has attracted much attention in recent years.[10,15]

Task-based learning (TBL) aims to enable students to perform optimally in their clinical roles.[15,16] Task-based education is generally implemented in medical students' internship and endows commitment to problem-based learning. In TBL, students acquire clinical competence, knowledge, and practical skills in the clinical setting and at the patient's bedside in a real-world setting that prepares them for their future professional roles.[17,18] In this method, learning objectives are set based on the duties of the health-care team, and learning occurs through the performance of tasks in authentic clinical situations. In this way, learners not only perform a task but also perceive the mechanisms and concepts related to that task following relevant communications. Students perform as collaborators, learn independently while working with others, acquire experience, link their theoretical knowledge to clinical experiences,[18,19] and develop their professional skills and competencies.[17]

Mentoring is defined as an interpersonal, interactive process occurring between the mentor and the mentee. Each mentee is assigned to a mentor to help them become familiar with the realities of his professional role.[5] The mentor provides support, training, facilitation, and feedback to the student.[20] A faculty member in a liaison role is also responsible for discussing learning objectives, monitoring progress, and bridging the gap between theoretical courses and practice.[21] Studies have shown that mentorship enhances students' professional development, creates a sense of collaboration, and strengthens competence, self-confidence, leadership skills, and interprofessional interactions in both the mentor and mentee.[22-24] Some studies on operating room nurses and surgical residents[5,14,25-28] also confirmed the positive effects of mentorship on learners and concluded that this method improves the quality of education and helps students to apply theoretical knowledge in real clinical settings, and develop their clinical competence. A study from Iran reported the effectiveness of mentorship on the perioperative competence of operating room nurses.[5] Another study also reported the superiority of TBL over the current teaching method in improving the knowledge and practice of surgical technologists.[10] However, no study has compared the effects of TBL and mentorship methods on surgical technology students. Therefore, the question arises as to which of the two methods - TBL and mentorship - is more effective in improving the perceived competence and clinical training conditions of surgical technology students.

Objectives

This study was conducted at Hamadan University of Medical Sciences to compare the effects of TBL and mentorship on the perceived surgical competence and clinical education condition of surgical technology students.

Methods

Study design and participants

This quasi-experimental study was conducted from April to June 2021. The statistical population included undergraduate surgical technology students studying at Hamadan University of Medical Sciences, of whom 50 qualified students were selected by the convenience sampling method. The sample size was determined according to a previous report by Ajorpaz *et al*.[5] The minimum sample size required was set at seven students per group according to the formula for comparing two means.

$$n = \frac{\left(z_1 \frac{\alpha}{2} + z_1 - \alpha\right)^2 \sigma^2}{d^2} = \frac{\left(1.96 + 0.84\right)^2 5.71\right)}{2.5^2}$$

However, predicting a possible sample loss and to increase the power of the statistical tests, 25 students were selected in each group. Eight surgical technology MSc students were selected as mentors for the mentorship training group. Inclusion criteria for participants were studying in the final semester of the surgical technology program (bachelor's degree) and not being a guest student. The only exclusion criteria were absence from more than two training sessions during the study. After selecting the students by the convenience sampling, they were randomly assigned to the intervention and control groups using a block randomization method. Before data collection, we created a plan for permuted block randomization using an online

number generator (i.e. https://www.sealedenvelope.com/simple-randomiserv1/lists), and the presumptive students were randomly allocated into 8 blocks of 6 and one block of 2 to be assigned to the TBL or mentorship groups, 25 in each [Figure 1].

Data collection instruments

A three-part instrument was used in this study that included a demographic questionnaire, the Perceived Perioperative Competence Scale-Revised (PPCS-R), and the Clinical Education Condition (CEC) questionnaires. The demographic questionnaire included items on students' age, gender, marital status, and the total grade point average, and was completed once at the time of admission for each student.

The first questionnaire was developed by Gillespie *et al*. in 2012 and contains 40 items in six subscales of foundational knowledge and skills (9 items), leadership (8 items), collaboration and communication (6 items), proficiency and expertise (6 items), empathy (6 items), and professional development (6 items). The reliability of this scale was determined using Cronbach's alpha of 0.96 for the whole scale and 0.81–0.89 for the subscales.[29] Ajorpaz *et al*. translated the PPCS-R into Persian and assessed its psychometric properties. The Persian version of the scale contains 33 items in five subscales of foundational skills and knowledge (7 items), leadership (9 items), collegiality (7 items), proficiency (4 items), and professional development (6 items). The Persian version of the scale presented a satisfactory psychometric properties and its reliability was confirmed by a Cronbach's alpha of 0.86. Similar to the original version, all items are scored on a 5-point Likert scale, from "1: never" to "5: always." The overall score of the Persian version can range from 33 to 163, with a higher score indicating better competence.[5,30]

The CEC questionnaire was an instrument developed by the researchers and adopted from the study by Sadati *et al*.[31] The questionnaire consists of four subscales, namely educational objectives and programs (11 items), instructor's performance (9 items), attitudes and behavior toward students (4 items), and monitoring and assessment (4 items). All items are scored as "yes: 3," "somewhat: 2," and "no: 1." The "Yes" answer is considered as satisfactory condition, the "somewhat" option represents a relatively desirable situation, and the "no" response is considered an unsatisfactory situation. The maximum and minimum scores were calculated in total and for each subscale. The total questionnaire score ranged from 28 to 84. Five faculty members from the Operating Room Department of Hamadan University of Medical Sciences confirmed the content validity of the CEC. The reliability of the instrument was also assessed through a test–retest approach with a correlation coefficient of 0.92 and a Cronbach's alpha of 0.94. The PPCS-R and the CEC questionnaire were completed by the students before and after the intervention.

Intervention

The students in the TBL group were trained for 4 weeks (3 days a week) in the operating room of Besat Hospital of Hamadan, whereas the students in the mentorship group were trained for the same period at Fatemieh Hospital of Hamadan. In the TBL group, students were educated by a faculty member, both theoretically and in clinical practice, on the four areas of the principles of scrubbing and circulating techniques,

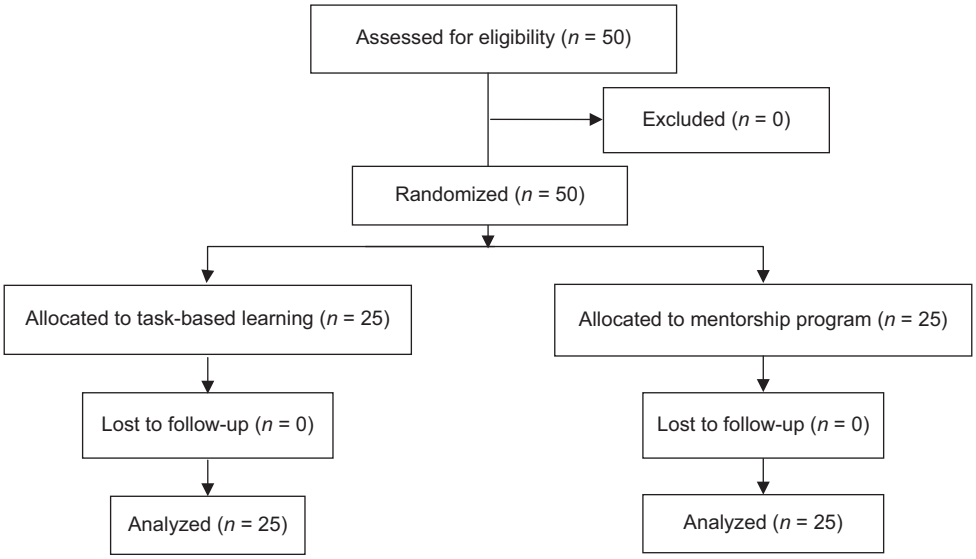

Figure 1: The study flow diagram

surgical technologies, sterilization, and surgical instruments and equipment in a specialized operating room. Videos and textbooks were also used to reinforce the education provided. The educational content was specifically prepared for the internship course and each specialized operating room.[10]

In the mentorship group, eight postgraduate surgical technology students played the role of mentors for the undergraduate surgical technology students as mentees, two faculty members played the role of educators and supervisors, and operating room staff were nonacademic instructors. All the eight mentors were trained by faculty members and performed the same method. Faculty members only monitored the performance of mentors and mentees but were not involved in the training process.

The mentorship program was carried out in three phases: (1) development of learning objectives, (2) the familiarization (i.e. facilitating learning and controlling, monitoring, and supporting mentees in clinical situations in performing approved standard methods), and (3) final assessment.

Through simple randomization, faculty members assigned three mentees to one of the mentors each day. The mentees and their mentors then attended the operating room. The mentors prepared learning opportunities for the mentees and helped them gain experience and skills in all aspects of patient care, understand patient problems, and achieve the course learning objectives. In addition, they taught mentees all aspects of general and specialty surgery, including circular and scrubbing nurse roles and techniques, suturing methods, specialty operating room equipment, patient care, correct recording and reporting. The mentors also provided their mentees with the required knowledge and tried to motivate them and improve their professional attitudes.

Ethical considerations

The study was approved by the Ethics Committee of Hamadan University of Medical Sciences (IR.UMSHA.REC.1400.172) and followed ethical considerations according to the Helsinki Declaration. All participants were informed about the purpose of the study and that they could leave the study at any time. They also signed a written informed consent form at the beginning of the study.

Data analysis

Data were analyzed using SPSS software version 16 (SPSS, Inc., Chicago, IL, USA). Descriptive statistics such as frequency, percentage, mean, and standard deviation were used to describe the data. The normality of quantitative variables was tested using the Kolmogorov–Smirnov test, and normal distribution was confirmed. Chi-square and Fisher's exact tests were used to compare the two groups in terms of nominal and categorical variables, and the independent samples *t*-test was used to compare the means of quantitative variables between groups. Paired samples *t*-test was used to compare the differences in quantitative variables before and after training in each group. The significance level was set at <0.05 in all tests.

Results

The mean age of the students was 20.68 ± 0.65 years. Students in the two groups did not differ significantly in mean age, gender, marital status, or grade point average ($P > 0.05$) [Table 1].

The independent samples *t*-test showed no significant difference between the two groups in the mean overall clinical competence score and its subscales before the intervention ($P > 0.05$). However, after the intervention, there were significant differences between the two groups in the mean overall clinical competence score ($P = 0.042$) and in the collegiality ($P = 0.043$), proficiency ($P = 0.035$), and professional development ($P = 0.009$) subscales [Table 2]. Withingroup comparisons using the paired *t*-test revealed that the mean scores of overall clinical competence and all of its subscales increased significantly in both the TBL and mentorship groups ($P < 0.05$) [Table 2].

According to the independent samples *t*-test, the mean baseline scores of the CEC and its subscales did not differ significantly between the two groups neither before nor after the intervention ($P > 0.05$) [Table 3]. However, the withingroup comparisons using the paired *t*-test revealed that the mean scores of overall CEC and all of its subscales increased significantly in both the TBL and mentorship groups ($P < 0.001$) [Table 3].

Table 1: Student's demographic characteristics in the task-based and mentorship educational groups

Variables	Groups		*P*
	Mentorship, *n* (%)	Task-based learning, *n* (%)	
Gender			
Male	10 (40)	6 (24)	0.230[a]
Female	15 (60)	19 (76)	
Marital status			
Single	19 (76)	20 (80)	0.735[a]
Married	6 (24)	5 (20)	
Age (mean±SD)	20.60 ± 0.64	20.76 ± 0.66	0.748[b]
Total grade point average (mean±SD)	16.87 ± 1.08	17.18 ± 1.10	0.650[b]

[a]Chi-square, [b]Independent *t*-test. SD: Standard deviation

Table 2: Between- and within- group comparisons of the mean scores of clinical competence and its subscales in task-based learning and mentorship groups

Variable/time	Groups (mean ± SD)		P^a
	Mentorship	Task-based learning	
Foundational skills and knowledge			
Before	20.16 ± 3.78	22.41 ± 4.59	0.064
After	23.96 ± 4.10	25.32 ± 3.93	0.238
P^b	<0.001	0.041	
Leadership			
Before	27.56 ± 5	28.68 ± 6.84	0.512
After	33.92 ± 5.24	34.44 ± 4.64	0.712
P^b	<0.001	0.007	
Collegiality			
Before	21.68 ± 3.98	22.64 ± 4.69	0.409
After	25.32 ± 3.65	27.68 ± 4.32	0.043
P^b	<0.001	<0.001	
Proficiency			
Before	12.52 ± 2.7	13.04 ± 2.8	0.507
After	14.72 ± 2.42	16.32 ± 2.77	0.035
P^b	<0.001	<0.001	
Professional development			
Before	17.80 ± 3.08	19.44 ± 3.61	0.090
After	22.32 ± 4.02	25.16 ± 3.31	0.009
P^b	<0.001	<0.001	
Overall clinical competence			
Before	99.72 ± 16.08	106.56 ± 18.34	0.167
After	120.24 ± 16.75	128.92 ± 12.49	0.042
P^b	<0.001	<0.001	

[a]Independent *t*-test, [b]Paired *t*-test. SD: Standard deviation

Table 3: Between- and within-group comparisons of the mean scores of clinical education condition and its subscales in task-based learning and mentorship groups

Variable/time	Groups (mean ± SD)		P^a
	Mentorship	Task-based learning	
Educational objectives and programs			
Before	21.48 ± 2.95	22.16 ± 5.20	0.572
After	27.40 ± 3.54	27.32 ± 2.79	0.930
P^b	<0.001	<0.001	
Instructor's performance			
Before	17.68 ± 3.48	18.08 ± 3.62	0.692
After	21.32 ± 2.71	22.68 ± 2.64	0.079
P^b	<0.001	<0.001	
Attitudes with students			
Before	6.76 ± 1.61	7.48 ± 2.04	0.172
After	10.52 ± 1.63	9.88 ± 1.39	0.143
P^b	<0.001	<0.001	
Monitoring and assessment			
Before	7.72 ± 1.90	7.84 ± 1.99	0.828
After	9.80 ± 1.47	9.92 ± 1.65	0.788
P^b	<0.001	<0.001	
Overall clinical education condition			
Before	53.64 ± 6.89	55.56 ± 9.45	0.415
After	69.04 ± 7.23	69.80 ± 6.38	0.695
P^b	<0.001	<0.001	

[a]Independent *t*-test, [b]Paired *t*-test. SD: Standard deviation

Discussion

The present study showed that both the TBL and mentorship methods could significantly increase the students' overall clinical competency score. However, the TBL group scored about 8 points greater than the mentorship group, and the difference was statistically significant. Although the mean scores of all clinical competence subscales increased in both study groups, the TBL group scored significantly higher in the two subscales of proficiency and professional development. However, between-group differences were not statistically significant for the other three subscales. Our findings on the effectiveness of TBL and mentorship are consistent with earlier studies in Iran.[5] and Maryland.[32] Our findings are also in line with the research evidence supporting the role of mentorship in promoting educational programs, particularly for operating room students.[5] However, the relatively better effects of TBL can be attributable to the fact that students are more independent in TBL, and this independence allowed them to truly collaborate with operating room staff and participate in the real-world decisions. These independent experiences led them to perceive themselves as more collegial and proficient, and ultimately helped them achieve a higher level of clinical competence.[17,33]

The present study showed that both the TBL and mentorship methods significantly improved the mean scores of the overall clinical education condition and all of its subscales, although the between-group differences were not statistically significant. These findings suggest that both methods were almost the same in improving the students' perceived clinical education condition. Consistent with our findings, a study in Pakistan showed the effectiveness of TBL in continuing medical education.[15] A systematic review also supported the effectiveness of mentorship in the improvement of the perceived clinical education condition.[34]

One of the strengths of this study was the participation of postgraduate surgical technology students as mentors, boosting the teaching quality and capability of the mentors. However, the study had some limitations. First, we did not use a control group because of the limited number of eligible students, we did not use a control

group. Furthermore, the present study was not blinded because of a lack of feasibility.

Conclusions

The present study showed that the clinical competence of students was higher in the TBL group than in the mentorship group. Nevertheless, both the TBL and mentorship training methods were effective in improving the clinical competencies of undergraduate surgical technology students and the clinical education condition. Therefore, educational authorities and instructors of surgical technology students are recommended to use TBL and mentorship methods in the internship courses of these students.

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Conflicts of interest

There are no conflicts of interest.

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