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Investigating the effect of video-based training on adherence of surgical positioning standards: a randomized controlled trial

Ali Nasiri Silab[1], Samira Fattahi[1*], Parisa Rizevandi[1] and Mobin Mottahedi[2]

Abstract

Background The operating room is a high-risk environment where proper patient positioning is crucial for minimizing injury and ensuring optimal access to surgical sites. This process requires effective collaboration among surgical team members, particularly operating room nurses who play a vital role in patient safety. Despite advancements in technology, challenges such as pressure injuries persist, with a significant incidence rate. Video-based training (VBT) emerges as a promising educational tool, enhancing knowledge retention and fostering a learner-centered approach. This study aims to evaluate the impact of VBT on adherence to surgical positioning standards, highlighting its potential to improve safety protocols in the operating room.

Methods In this clinical trial, 62 qualified operating room nurses (50 women, 12 men, average age: 28.90 ± 3.75 years) were randomly divided into control and intervention group ($n = 31$ in each group). The control group only received positioning recommendations, but in the intervention group, in addition to the recommendations, video-based surgical positioning training was performed for 1 month, at least 3 times a week. The performance of nurses in both groups was evaluated through a researcher-made checklist at baseline and post-intervention.

Results Based on findings, there was no significant difference between the two groups in compliance with surgical positioning standards at baseline ($p = 0.07$). However, after the intervention, compliance scores significantly improved in the VBT group compared to the control group ($p < 0.001$). The VBT group showed a mean improvement of 62.12 points, while the control group improved by 10.77 points ($p < 0.001$).

Conclusions This preliminary study demonstrated a notable improvement in compliance with surgical positioning standards among operating room nurses following VBT intervention. Despite the promising results, the small sample size and preliminary nature of the research necessitate further studies to confirm these findings and assess long-term outcomes. These initial insights highlight the potential of innovative training methods in enhancing surgical practices.

Keywords Surgical positioning, Video-based training, Nurses, Operating room, Surgical complications

*Correspondence:
Samira Fattahi
s_fatahi20@yahoo.com
[1]Department of Operating Room, School of Paramedicine, Kermanshah University of Medical Sciences, Kermanshah, Iran
[2]Department of Operating Room, School of Allied Medicine, Shahroud University of Medical Sciences, Shahroud, Iran

Background

The operating room is known as one of the most dangerous environments in hospitals [1]. Proper patient positioning is an important part of any surgery and is important for access to the appropriate surgical field and can minimize the risk of injury [2]. Coordinating patient positioning during surgery involves collaboration among the surgeon, anesthesiologist, nurse anesthetist, and operating room nurse, where the operating room nurse plays a key role in protecting the patient from harm [3]. Given the rising technical complexity of surgical procedures, patient positioning has become challenging. Consequently, adjustments are necessary to cater to various procedures and individual requirements [2]. During surgery, there is a risk of high-impact events related to patient positioning, which can have severe consequences [4].

Overall, the aim of surgical positioning is to provide optimal access to the surgical site while minimizing physiological damage to the patient. When the patient is unconscious, the surgical team, particularly the operating room nurses, bear the responsibility [5]. It is crucial to observe safety precautions during patient movement and surgery [6]. Operating room personnel must acquire the necessary knowledge related to surgical methods, anesthesia and the patient's medical conditions in order to prevent patient safety incidents [7]. Despite significant technological advancements, pressure injuries caused by surgical positioning remain a prominent challenge in clinical care with an incidence of 1.3–54.8%. Patients who experience injuries during the postoperative period face an elevated risk of sepsis, pneumonia, and other adverse effects that can lead to death [8]. Proper patient positioning is critical in the operating room, necessitating specialized training for nurses [9].

Video-based training (VBT) serves as an educational approach where learning occurs indirectly. One of its benefits lies in its capacity to facilitate information storage and continuity, while also being user-friendly and cost-effective [10]. Additionally, VBT has the potential to shift the traditional teacher-centered educational model toward a more learner-centered approach [11].

Effective health education relies on appropriate facilities and equipment. Visual media, which has evolved alongside technological advancements, plays a crucial role in education. VBT, when well-visualized, enhances knowledge absorption. Educational films fall within the audiovisual category, engaging both hearing and sight senses, leading to improved learning outcomes such as memorization, recall, and connecting knowledge to real-world contexts [12, 13]. Technology has become an essential part of the teaching process, and its advances lead people to use electronic education [14]. The results of a review study showed that video is becoming one of the most powerful learning media that records and distributes information and makes learners better understand and retain information [15].

Given the potential consequences of inadequate positioning and the critical role of correct surgical positioning in patient safety within the operating room, previous research has not adequately explored the impact of VBT on adherence. This study aims to assess the effect of VBT on adherence to surgical positioning standards, considering the existing guidelines.

Methods

Participants

This randomized and parallel controlled trial (IRCT20211225053524N1) was conducted during 11 months from February 2023 to January 2024 in Kermanshah, Iran (a city located in western Iran). The studied population were operating room nurses working in Kermanshah hospitals, who were divided into two VBT and control intervention groups with a ratio of 1:1. Our study adheres to CONSORT guidelines.

The inclusion criteria were: interested in participating in research, at least diploma degree in operating room nursing, failure to receive prior training based on surgical positioning training videos, working in neurosurgery, orthopedics and gynecology operating rooms with at least one year of work experience. Participants who had unwillingness to complete the questionnaire, attending training workshops on positioning standards during the research period, were excluded.

Sample size

The sample size for this randomized controlled trial was calculated to ensure adequate power to detect significant differences in compliance scores with surgical positioning standards between the VBT group and the control group. A total of 62 operating room nurses were recruited for the study, with 31 participants assigned to each group. Using the significance level (α) of 0.05 and the desired power (1 - β) of 0.80, the sample size was determined using the following formula to compare the means:

$$n = \left(\frac{\left(Z_{\alpha/2} + Z_{\beta}\right)^2 \cdot \left(\sigma_1^2 + \sigma_2^2\right)}{\left(\mu_1 - \mu_2\right)^2} \right)$$

Randomization and blinding

In the randomization process, an external individual used software to generate a series of non-repeating, consecutive even and odd numbers. These numbers were then transcribed onto similar cards and placed inside 62 sealed envelopes. The envelopes were handed over to the researcher. After assessing eligibility, each participant

was instructed to open an envelope. If the card inside had an even number, they were assigned to the intervention group; if it was an odd number, they joined the control group. Participants were aware of the intervention, while the data collector remained blinded.

Intervention

Participants in the intervention group received VBT on surgical positioning standards. These videos, sourced from reputable materials and approved by experts in the field, covered patient safety, prevention of pressure ulcers, nerve protection, optimal surgical positioning, blood circulation maintenance, and teamwork. The nurses received the videos via communication platforms such as WhatsApp, Telegram, or IMO. Participants were asked to watch the videos at least three times per week for one month. To ensure compliance, the researcher maintained contact through these platforms, monitored video viewing using a checklist, and sent reminders if participants missed any sessions.

In the control group, nurses were verbally instructed by the researcher on the importance of adhering to surgical positioning standards. The verbal instructions were given three times over the one month, matching the timeline of the intervention group. No additional materials, such as videos, were provided to the control group. At the end of the study, all participants in the control group were offered access to the educational videos for ethical reasons.

Pre- and post-testing

The pre-test was conducted before the intervention to establish a baseline of the participants' adherence to surgical positioning standards. After obtaining informed consent, participants in both the intervention and control groups were asked to complete the checklist, which was administered by a blinded evaluator who was unaware of group assignments. The pre-test checklist evaluated the participants' knowledge and practical skills related to correct surgical positioning.

After the one-month intervention, the post-test was conducted using the same checklist to assess any changes in performance. The post-test was administered in the same manner, with the same evaluator conducting the assessment to maintain consistency. Both pre-and post-tests were conducted within one week before and after the intervention, respectively. The results from both tests were then compared to determine the effect of the VBT on the intervention group, and any natural progression in the control group.

Assessment of content validity

The checklist used to assess adherence to surgical positioning standards was validated by a panel of 10 experts from the Faculty of Paramedicine at Kermanshah University of Medical Sciences. These experts evaluated the necessity, relevance, clarity, and simplicity of each item. Using Lawshe's method, we calculated the Content Validity Ratio (CVR), with a minimum acceptable value of 0.62 for a 10-person panel. The checklist items were also evaluated for the Content Validity Index (CVI) across three dimensions: relevance, simplicity, and clarity. Items with a CVI between 0.7 and 0.8 were significantly revised, while those scoring between 0.8 and 0.9 were partially revised. Items with a CVI above 0.9 remained unchanged. The final checklist consisted of 42 items. The reliability of the checklist was confirmed using Cronbach's alpha, yielding a coefficient of 0.88, indicating high internal consistency.

Data analysis

The data analysis was conducted using SPSS software version 25. A significance level of $p<0.05$ and a confidence interval (CI) of 95% were employed as the criteria for determining statistical significance. The normality of the data was assessed using the Shapiro–Wilk test. Descriptive and inferential statistics were then utilized to summarize and analyze the data, including Chi-square tests, Fisher's exact test, the paired t-test, and independent samples t-test.

Result

In the present study, 62 operating room nurses were divided into two intervention and control groups. All participants successfully completed the study (Fig. 1). Demographic data analysis showed that the groups were homogeneous (Table 1).

Based on the findings of the Independent Samples t Test, the mean difference in baseline scores between the control group and the VBT group was 1.84 ($P=0.07$), while the mean difference in scores after the intervention was 13.29 ($P<0.001$) (Table 2).

Furthermore, the results of the paired t-test indicated that the mean difference in scores between baseline and after the intervention was 10.77 ($P<0.001$) in the control group and 62.12 ($P<0.001$) in the video-based training group (Table 3).

Overall, the study demonstrated that there was no significant difference in compliance scores with surgical positioning standards before the intervention (baseline) between the control group and VBT group. However, after the intervention, there was a significant difference in compliance scores between the two groups, with the VBT group showing greater improvement compared to the control group (Fig. 2).

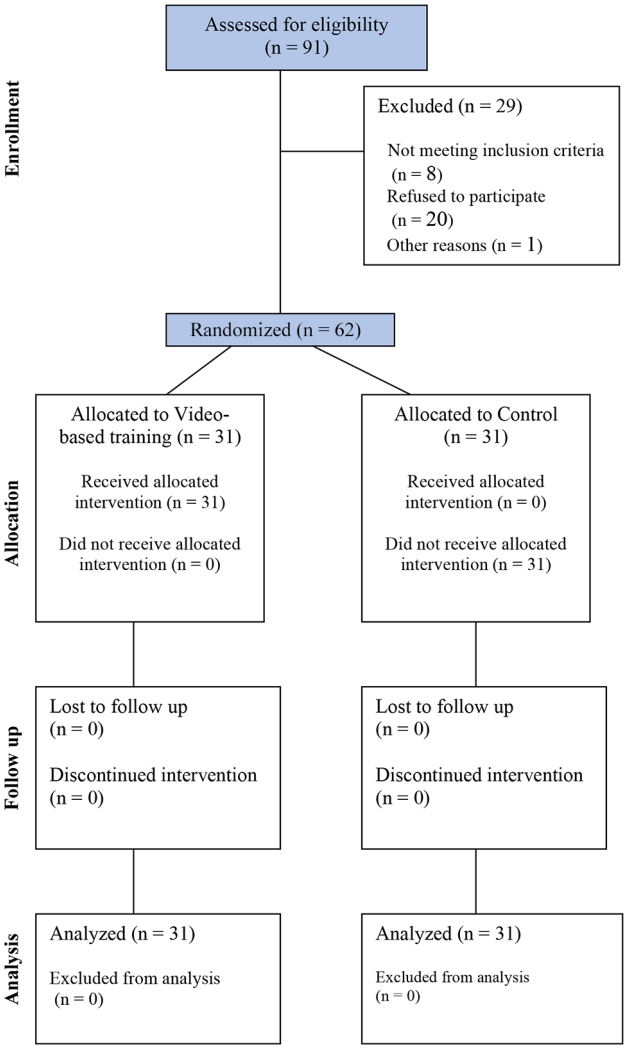

Fig. 1 CONSORT flow diagram

Table 1 Baseline characteristics of the samples

Variables	Group (Mean ± SD)		*P*-value
	Video-Based Training (*n* = 31)	Control (*n* = 31)	
Gender (Female/Male)	25/6	25/6	1.00*
Height (m)	167.67 ± 7.08	182.88 ± 8.93	0.89**
Weight (kg)	66.74 ± 14.15	64.96 ± 9.65	0.56**
BMI (kg/m^2)	23.57 ± 3.51	23.10 ± 2.37	0.53**
Educational level (Bachelor/Master)	27/4	29/2	0.67***
The number of monthly shift	28.38 ± 6.45	28.54 ± 5.62	0.91**
Work Experience (years)	5.87 ± 3.10	4.19 ± 4.72	0.10**

SD: Standard deviation, BMI: Body mass index, * Chi-Square test, ** Independent samples t-test, *** Fisher's exact test

Discussion

The present study evaluated the effectiveness of VBT in improving adherence to surgical positioning standards among operating room nurses. This randomized controlled trial represents a pioneering effort to explore the impact of VBT on compliance within this specific population. Our findings indicate that VBT significantly enhanced adherence to surgical positioning standards compared to the control group.

The improvement in adherence can be attributed to the engaging nature of VBT. Multimedia approaches, which combine visual and auditory elements, have been shown to enhance cognitive engagement and information retention [16]. By presenting systematic instructions in a visually appealing format, VBT encourages active participation and critical thinking among nurses. This engagement is particularly essential in high-stakes environments like the operating room, where improper patient positioning can lead to severe complications, including nerve damage and pressure injuries [17].

Furthermore, studies by Clerkin et al. [18] and Weber et al. [19] have demonstrated that video-based educational interventions can significantly enhance psychomotor skills and learning effectiveness among healthcare professionals. Our study extends this understanding by highlighting the specific relevance of VBT in the context of surgical nursing, where adherence to safety protocols directly impacts patient outcomes.

The positive results observed in our study align with findings from Ayhan et al. [20], who reported significant improvements in nursing education outcomes through video interventions. In their research, the incorporation of educational videos was found to enhance not only knowledge but also motivation and confidence among nursing students. This suggests that VBT could serve as an effective tool for continuous professional development in surgical settings, fostering a culture of safety and competence.

However, it is important to acknowledge that not all studies have found VBT to be superior to traditional methods. For example, Nousiainen et al. [21] and Stutz et al. [22] reported no significant differences in learning outcomes between video-based and other educational interventions. Such discrepancies may arise from variations in study designs, content delivery methods, and the specific skills being evaluated. This highlights the need for a tailored approach in educational interventions, recognizing that different training methods may be more effective for specific contexts and skill sets [23].

The implications of our study extend beyond immediate improvements in adherence to surgical positioning standards. Enhanced compliance can lead to a reduction in the incidence of pressure injuries, which have been reported to affect 1.3–54.8% of surgical patients [8]. Furthermore, improving adherence to positioning standards may also decrease the risk of other complications, such as postoperative infections and prolonged recovery times [24]. This underscores the critical importance of

Table 2 Intergroup comparison of compliance scores with surgical positioning standards at baseline and after intervention in video-based training group and control

Measurement period	Groups	Mean ± SD	Min	Max	df	F	t	*P*-value	95% CI
Baseline	Control	79.58 ± 5.84	70	95	60	0.06	1.84	0.07	-0.25 to 6.25
	Video-based training	82.58 ± 6.90	70	101					
After intervention	Control	90.35 ± 18.30	76	157	60	0.10	13.29	< 0.001	46.17 to 62.53
	Video-based training	144.70 ± 13.53	124	162					

SD: standard deviation, Min: minimum, Max: maximum, CI: confidence interval, df: Degrees of freedom

Table 3 Intra-group comparison of compliance scores with surgical positioning standards at baseline and after intervention in video-based training group and control

Groups	Measurement period	Mean ± SD	Min	Max	t	*P*-value	95% CI
Control	Baseline	79.58 ± 5.84	70	95	-10.77	< 0.001	-17.91 to -3.62
	After intervention	90.35 ± 18.30	76	157			
Video-based training	Baseline	82.58 ± 6.90	70	101	-62.12	< 0.001	-67.20 to -57.05
	After intervention	144.70 ± 13.53	124	162			

SD: standard deviation, Min: minimum, Max: maximum, CI: confidence interval

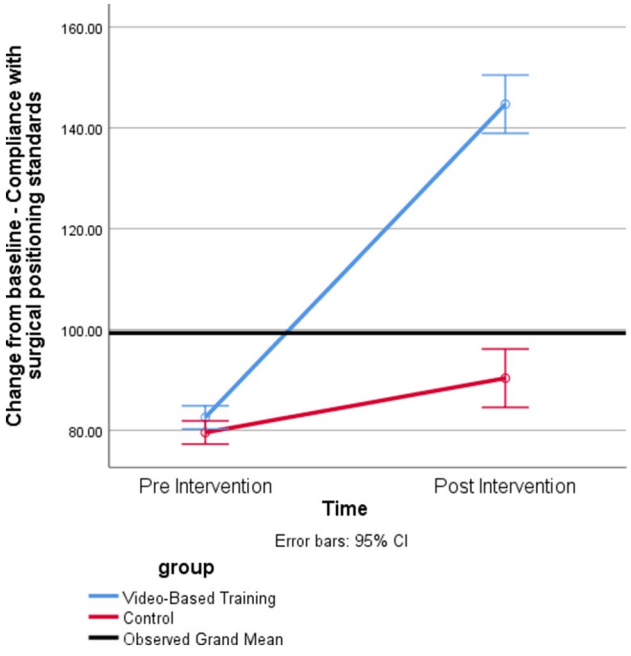

Fig. 2 Change from baseline in surgical positioning standards scores over time

continuous education and training for operating room staff, as adherence to safety protocols is a key component of patient safety.

Future research should explore the long-term impact of VBT on surgical practices and patient outcomes. Additionally, investigating the scalability of such training methods across various surgical specialties could provide valuable insights into standardizing patient safety protocols. It would also be beneficial to assess the cost-effectiveness of implementing VBT as a regular component of staff education programs.

In conclusion, our study highlights the potential of VBT as a transformative approach to enhancing adherence to surgical positioning standards among operating room nurses. By focusing on the effectiveness of this educational intervention, we can contribute to improving safety protocols in surgical environments and ultimately enhance patient care. As healthcare continues to evolve, integrating innovative training methods like VBT will be essential in preparing nursing staff to meet the demands of complex surgical procedures.

Study limitations

This study has several limitations that should be acknowledged. First, while participants in the intervention group were asked to watch the educational videos at least three times per week, we relied on self-reporting and reminders to monitor adherence. Although the researcher maintained regular contact and used a checklist to track compliance, we could not independently verify whether participants consistently watched the videos the recommended number of times. This may have introduced variability in the actual exposure to the intervention across participants. Second, this study was conducted at a single center in Kermanshah, Iran, which may limit the generalizability of the findings to other settings or regions. Operating room practices and adherence to positioning standards may vary across hospitals, cultures, and healthcare systems, and thus the results may not be fully applicable to different contexts. Additionally, the study population consisted only of nurses working in neurosurgery, orthopedics, and gynecology operating rooms, which may further limit the generalizability of the findings to nurses in other specialties or departments. Finally, the relatively short duration of the intervention (one month) and follow-up period might not capture long-term changes in adherence to positioning standards or sustained effects of the VBT. Future studies with a longer follow-up period and conducted in multiple centers are

needed to explore further the impact of this intervention on a broader scale.

Conclusion

This preliminary study evaluated the impact of VBT on compliance with surgical positioning standards among operating room nurses. The results indicated a significant improvement in adherence scores in the intervention group compared to the control group after the intervention. While these findings suggest that VBT could be an effective educational tool for enhancing compliance with surgical positioning standards, it is important to interpret the results with caution due to the study's preliminary nature and the limited sample size. Further research with larger sample sizes and multicenter designs is necessary to validate these findings and explore the long-term effects of VBT on adherence to surgical standards. Overall, this study provides initial insights into the potential benefits of innovative training methods for improving surgical practices among operating room staff.

Abbreviations

VBT	Video-based training
CVR	Content validity ratio
CVI	Content validity index
CI	Confidence interval

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Author contributions

A.N. and S.F. wrote the main manuscript text/ M.M. prepared figures and tables/ S.F. and P.R. Conception/A.N. Initial draft/All authors reviewed the manuscript.

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Data availability

No datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participate

This clinical trial was registered after the review and approval of the Ethics Committee of Kermanshah University of Medical Sciences (ID: IR.KUMS.REC.1401.548). It is also registered on irct.behdasht.gov.ir with the code IRCT20211225053524N1. Eligible volunteers were given an informed consent form to sign after a clear explanation of the protocol, objectives, and possible benefits of participating in the research.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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References

1. Bates DW, Levine DM, Salmasian H, Syrowatka A, Shahian DM, Lipsitz S, et al. The safety of inpatient health care. N Engl J Med. 2023;388(2):142–53.
2. Burlingame BL. Guideline implementation: positioning the patient. AORN J. 2017;106(3):227–37.
3. Bjøro B, Ballestad I, Rustøen T, Fosmark MH, Bentsen SB. Positioning patients for robotic-assisted surgery: a qualitative study of operating room nurses' experiences. Nurs open. 2023;10(2):469–78.
4. Bentsen SB, Eide GE, Wiig S, Rustøen T, Heen C, Bjøro B. Patient positioning on the operating table and patient safety: a systematic review and meta-analysis. J Adv Nurs. 2023.
5. Sajid MS, McFall MR, Whitehouse PA, Sains PS. Systematic review of absorbable vs non-absorbable sutures used for the closure of surgical incisions. World J Gastrointest Surg. 2014;6(12):241.
6. Sillero-Sillero A, Zabalegui A. Safety and satisfaction of patients with nurse's care in the perioperative. Rev Latinoam Enferm. 2019;27:e3142.
7. Lee MY, Kim SS. A safety simulation program for operating room nurses. Clin Simul Nurs. 2018;18:6–13.
8. Eberhardt TD, de Lima SBS, de Avila Soares RS, Silveira LBTD, Rossarola Pozzebon B, Reis CR, et al. Prevention of pressure injury in the operating room: heels operating room pressure injury trial. Int Wound J. 2021;18(3):359–66.
9. Helmreich RL, Schaefer H-G. Team performance in the operating room. Human error in medicine: CRC; 2018. pp. 225–54.
10. Al-Shaqsi S, Hong B, Austin RE, Wanzel K, editors. Practice management knowledge amongst plastic surgery residents in Canada: a national survey. Aesthetic Surgery Journal Open Forum; 2020: Oxford University Press US.
11. Guseva Y, Kauppinen T, editors. Learning in the era of online videos: How to improve teachers' competencies of producing educational videos. International Conference on Higher Education Advances; 2018: Editorial Universitat Politècnica de València.
12. Piola WS, Ali L, Rokani M. The Effect of Health Education using video media on knowledge about bullying in Class VII Students of SMPN 1 Dungaliyo. J Community Health Provis. 2022;2(1):69–72.
13. Haleem A, Javaid M, Qadri MA, Suman R. Understanding the role of digital technologies in education: a review. Sustainable Oper Computers. 2022;3:275–85.
14. Kolekar SV, Pai RM, MM MP. Adaptive user interface for moodle based E-learning system using learning styles. Procedia Comput Sci. 2018;135:606–15.
15. Sablić M, Mirosavljević A, Škugor A. Video-based learning (VBL)—past, present and future: an overview of the research published from 2008 to 2019. Technol Knowl Learn. 2021;26(4):1061–77.
16. Mayer RE. Multimedia learning. Psychology of learning and motivation. Volume 41. Elsevier; 2002. pp. 85–139.
17. Garutti I, Cabañero A, Vicente R, Sánchez D, Granell M, Fraile C, et al. Recommendations of the Society of Thoracic Surgery and the section of cardiothoracic and vascular surgery of the Spanish Society of Anesthesia, Resuscitation and Pain Therapy, for patients undergoing lung surgery included in an intensified recovery program. Revista Española De Anestesiología Y Reanimación (English Edition). 2022;69(4):208–41.
18. Clerkin R, Patton D, Moore Z, Nugent L, Avsar P, O'Connor T. What is the impact of video as a teaching method on achieving psychomotor skills in nursing? A systematic review and meta-analysis. Nurse Educ Today. 2022;111:105280.
19. Weber U, Constantinescu MA, Woermann U, Schmitz F, Schnabel K. Video-based instructions for surgical hand disinfection as a replacement for conventional tuition? A randomised, blind comparative study. GMS J Med Educ. 2016;33(4).
20. Ayhan AGY, Cekic Y, Ancel G. Psychiatric nursing education: films and reflections/Psikiyatri hemsireligi egitimi: Filmler ve Yansimalari. Anadolu Psikiyatri Dergisi. 2018;19(4):362–70.
21. Nousiainen M, Brydges R, Backstein D, Dubrowski A. Comparison of expert instruction and computer-based video training in teaching fundamental surgical skills to medical students. Surgery. 2008;143(4):539–44.
22. Stutz L, Koertgen B, Scheier T, Klaentschi T, Junge H, Kolbe M, Grande B. Improving compliance with isolation measures in the operating room: a prospective simulation study comparing the effectiveness and costs of simulation-based training vs video-based training. J Hosp Infect. 2023;141:167–74.
23. Zare Bidaki M, Yousefi M, Malaki Moghadam H, Rajabpour Sanati A, Nazari-Alam A. The effectiveness of clip-based education on academic learning and satisfaction in microbiology course of health students. J Sci Res Med Sci. 2018;25:37–45.

24. Andersen BM, Andersen BM. Prevention of postoperative wound infections. Prev Control Infections Hospitals: Pract Theory. 2019:377–437.

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