Original Article

A systematic review and meta-analysis of the influence of case analysis teaching in clinical anesthesia education

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Background: The success or failure of anesthesia determines the success or failure of surgery. Therefore, more attention should be paid to the training of students majoring in clinical anesthesia. Traditional teaching methods rely on teacher explanation, and thus students depend greatly on their teachers. In recent years, case analysis teaching has become increasingly popular as an educational mode and is widely praised by students. Many studies have shown that case analysis teaching can not only improve students' enthusiasm but also enable students to apply what they have learned into clinical practice.

Methods: The English databases PubMed, Embase, and Ovid MEDLINE were searched from database establishment to April 2021, with the keywords "case analysis teaching", "clinical anesthesia teaching", and "effect analysis". Review Manager 5.3 was used for meta-analysis of experimental data.

Results: A total of 3 documents involving 143 students were analyzed to investigate the influence of case analysis teaching in clinical anesthesia education. The results showed that after case analysis teaching, students in the experiment group scored significantly higher than those in the control group, and the difference was statistically significant (MD =2.50, 95% CI: 1.84–3.16, Z=7.41, P<0.00001).

Discussion: Studies have found that case analysis teaching allows students to better master knowledge. This meta-analysis analyzed 3 previous studies to investigate the influence of case analysis teaching in clinical anesthesia education.

Keywords: Case analysis teaching; clinical anesthesia; influence analysis; meta-analysis

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Introduction

Anesthesiology plays a critical role in the diagnosis and treatment of diseases; therefore, the study of anesthesiology is an important part of medical education. However, as a subject, anesthesiology relies on a complex knowledge system with difficult content, and teaching this content can be challenging (1). In recent years, anesthesiology teaching has benefitted from the introduction of new teaching modes. One of these modes, case analysis teaching, is now frequently used in anesthesia education (2). For example, the case analysis teaching method and simulation teaching method are all good teaching methods. Among them, the most effective is the case analysis teaching method. Case analysis teaching can help students master

curriculum knowledge and can shorten the transition time from knowledge acquisition to the development of clinical skills, allowing students to adapt to the needs of future clinical work (3). The use of case analysis in anesthesiology education enables students to master anesthesia procedures during their studies and provides opportunities to discover, analyze, and solve problems, laying a strong foundation for future clinical anesthesia work (4). In addition, case analysis teaching can improve students' interest in learning (5). Case analysis relies on active learning rather than the negative passive teaching of a teacher speaking and students listening. Such a learning mode encourages students to think independently in order to correctly solve problems, which can deepen students' understanding of curriculum knowledge (6,7). Case analysis is conducive to the consolidation of knowledge (8). By applying learned knowledge in practical situations, students can form their own knowledge network and transform theoretical understanding into active learning and problem solving, which in turn accelerates their acquisition of new knowledge (9,10). Case analysis connects theory with practice (11). When students are given the opportunity to apply curriculum knowledge to real-world situations, they can actively participate in teaching, instead of passively learning (12). Students learn theoretical knowledge to solve practical problems that may arise in the clinic, and linking this theory with practice promotes the mastery of knowledge (13,14). Although the case analysis teaching method showed various advantages, related research in China started relatively late. There is a lack of accurate, reliable, and effective summary and analysis of its specific effects.

Studies have shown that case analysis teaching has achieved good results in medical education, enabling students to apply their knowledge in practical work. Given the importance of anesthesiology in medicine, it is important to study the influence of this teaching mode on anesthesiology students. In this meta-analysis, we analyzed 3 previous studies to systematically assess the influence of case analysis teaching on students in clinical anesthesia education. Our study provides an important theoretical basis and support for the effective teaching of clinical anesthesia. We present the following article in accordance with the PRISMA reporting checklist (available at https://apm.amegroups.com/article/view/10.21037/apm-21-3832/rc).

Methods

Literature retrieval

A comprehensive systematic review was conducted as per the Cochrane Handbook for Systematic Reviews of Interventions. PubMed was searched for literature involving patients with atopic dermatitis using the keywords "Case Analysis Teaching", "Clinical Anesthesia", "Effect Analysis", and "Effectiveness". The included literature was related to the pathogenesis of atopic dermatitis.

Literature inclusion and exclusion criteria

The inclusion criteria were as follows: (I) randomized controlled trials (RCTs) on the influence of case analysis teaching in clinical teaching; (II) the experimental group adopted case analysis teaching, and the students in the control group received another teaching method; (III) observation indicators involved pre- and post-class teaching scores and students test scores; and (IV) literature with complete data.

The exclusion criteria were as follows: (I) summary, case reports, and other documents; (II) repeatedly published reports; (III) observation indicators were missing; and (IV) Chinese literature.

Literature screening

Two researchers read the title and abstract first. Any inconsistencies were solved by discussion or inviting another researcher for arbitration. When the title and abstract met the requirements, the researchers then read the full text. Duplicates were deleted using NoteExpress 2.0 (http://www.inoteexpress.com/index.htm).

Data extraction

Two researchers extracted relevant information from all eligible studies, including the author, publishing year, sample size, age, country, gender, degree, and the course of the disease. If data were missing, the researchers contacted the original author via email to obtain the relevant data. If the data were not obtainable, the Cochrane evaluation manual was used to convert the data, such as calculating the standard deviation of continuous data.

Quality evaluation

Quality evaluation was conducted using the "risk-of-bias assessment" recommended by the Cochrane methodology. The evaluation included the following 7 items: (I) which random method was used; (II) whether allocation concealment was adopted; (III) whether patients and researchers were blinded; (IV) the effect of the blind method; (V) whether the result data were complete; (VI) whether the results of the survey were credible; (VII) other biases. If a document satisfied the above 7 items, it had a small bias; if not, it had a high bias. If the above items were not mentioned, the bias was unclear. A score between 1–3 points indicated low quality, and a score between 4–7 indicated high quality.

Data extraction

In the Cochrane methodology, a forest plot is used to express the research results of each study by combining their confidence intervals (CIs). If there is no overlap between the CI of each study, there is no heterogeneity between the studies. Within acceptable heterogeneity, a random-effects model can be used in combination with a fixed-effect model for further subgroup analysis. The effect size of the subgroup is analyzed to identify which model to use. A sensitivity analysis is used to investigate whether a single study affects the total results of the combined studies. Studies affecting the total results are removed, and the remaining studies are combined to obtain the total results. Next, each study is compared with the total results. Studies are considered to have an impact on the results of the review in the following 2 cases: (I) if a study is deleted and the estimated value of the combined effect size is outside the 95% CI of the combined effect size; (II) if a study is deleted and the results differ greatly. If a study has little influence on the overall results, its sensitivity is low, which indicates that the results obtained are stable and the conclusion is correct.

Statistical analysis

The RevMan 5.3 software (Cochrane, London, UK) was used to process the data, When I^2 was <50% and P was >0.05, it indicated significant heterogeneity and the fixed-effect model was used; when I^2 was ≥50% and P was ≤0.05, it indicated no significant heterogeneity and the random-effects model was used. The combined effect assessment relied on mean difference (MD) or odds ratio (OR) and 95% CIs, and then a forest plot was drawn to represent the results. Studies with large heterogeneity were eliminated, and the possible source of the heterogeneity was analyzed. A sensitivity analysis was then conducted. If an indicator was involved in ≥5 RCTs, it was necessary to evaluate publishing bias, and a funnel map was drawn.

Results

Literature retrieval results

A total of 1,131 related articles were retrieved in this study, including 453 from the PubMed database, 242 from the Embase database, and 436 from the Ovid MEDLINE database. First, 643 duplicates were eliminated. Then, after reading the titles and abstracts, 398 documents were further removed. Next, after reading the full text, 87 documents were eliminated, and finally 3 articles were included (15-17), as shown in *Figure 1*. The basic information of these articles is shown in *Table 1*.

Risk-of-bias evaluation

The Cochrane Handbook 5.3 was used to evaluate the risk of bias of the 3 documents (*Figures 2,3*), and the results were expressed using RevMan 5.3.

Theoretical test scores after anesthesia teaching

The index of students' theoretical test scores after case-based teaching was P<0.00001, I^2=84%, so the random-effects model was used. The results showed that there were differences between the 2 groups of students in theoretical test scores (MD =4.69, 95% CI: 0.96–8.42, P<0.00001; *Figure 4*).

Taking the students' theoretical test scores as the index, the inverted funnel plot showed that the scatter points were roughly in the shape of a bottom-down funnel arranged symmetrically along the horizontal axis, indicating that publication bias was not obvious, as shown in *Figure 5*.

Pre- and post-class test scores

Among the included studies, there were 2 articles that included a comparison of pre- and post-class scores. The total pre-class score index was P<0.00001, I^2=91%, so the random-effects model was used. The results showed that

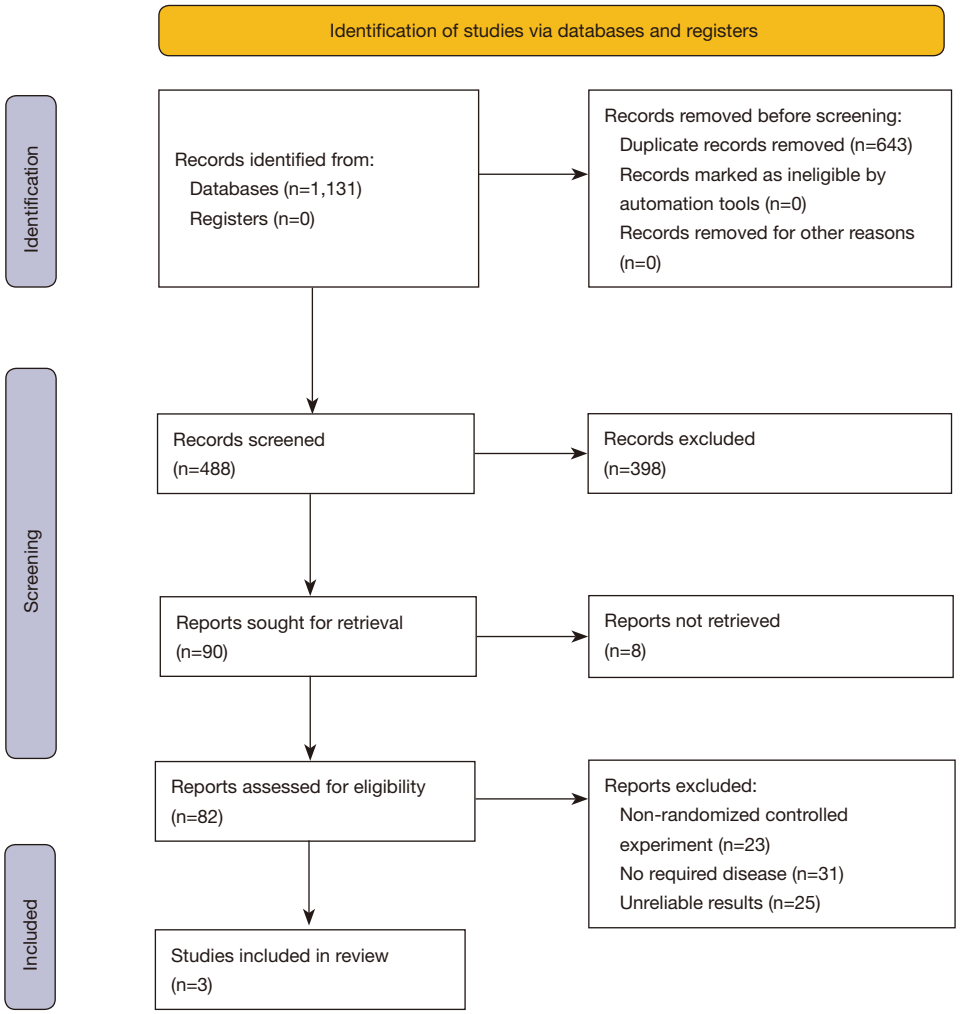

Figure 1 Literature retrieval flowchart.

Table 1 The basic information of the included literature

The first author and the publishing year	Sex		Age		Cases		Indicators
	Experiment group (male/female)	Control group	Experiment group	Control group	Experiment group	Control group	
Farina C [2021] (15)	Unclear	Unclear	Unclear	Unclear	17	19	Quiz, test, and student satisfaction survey scores
Kim TW [2019] (16)	Unclear	Unclear	Unclear	Unclear	10	17	Cost analysis, scores on both the posttest and posttest 1 tests
Bi M [2019] (17)	12/28	16/24	25.91±4.17	26.15±3.92	40	40	Self-evaluation, satisfaction, examination results

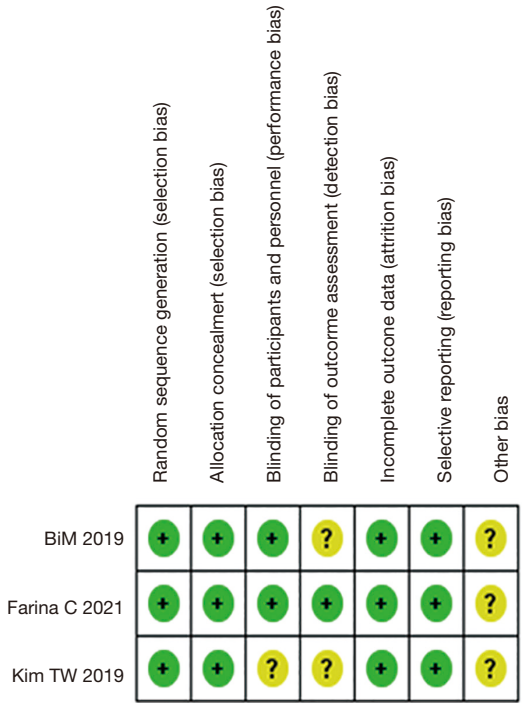

Figure 2 Risk-of-bias evaluation of the included literature.

there were statistical differences in pre-class scores (MD =–0.32, 95% CI: –0.63 to –0.02, Z=2.09, P=0.04) and post-class scores (MD =1.29, 95% CI: –0.81 to 3.38, Z=1.20, P=0.23) between the 2 groups. The total combined effect between the 2 groups had no statistical difference (MD =0.40, 95% CI: –0.36 to 1.17, Z=1.03, P=0.30), as shown in *Figure 6*.

Taking the pre- and post-class scores as the index, the inverted funnel plot showed that the scatter points were roughly in the shape of a bottom-down funnel arranged symmetrically along the horizontal axis, indicating that publication bias was not obvious, as shown in *Figure 7*.

Discussion

Traditional teaching methods rely heavily on the teaching of theory and curriculum concepts (18). In this mode, the teacher explains theoretical knowledge and students passively accept this knowledge. Traditional teaching methods are not as effective as other teaching strategies in cultivating critical thinking skills in practical application.

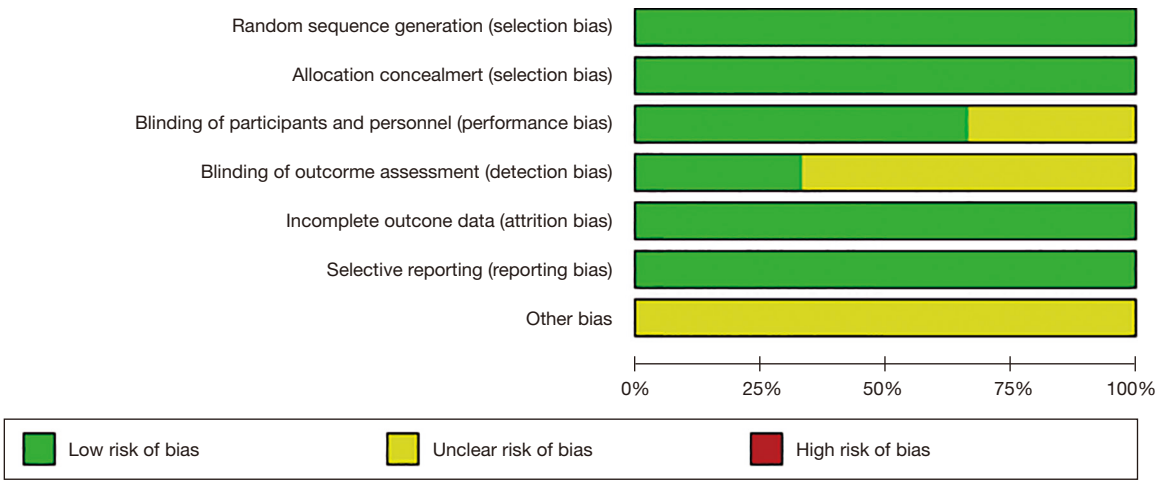

Figure 3 Bar chart showing the risk of bias results of the included literature.

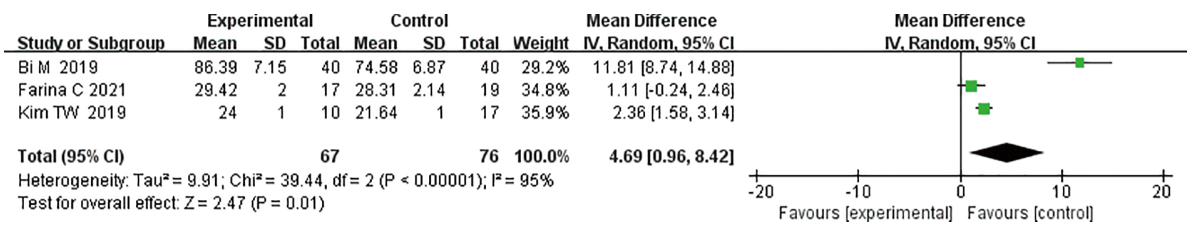

Figure 4 Forest plot of theoretical test scores after anesthesia teaching.

Medical teaching involves many knowledge points, and the traditional teaching of this content is unengaging and does not promote problem solving, collaborative learning, or strategies for lifetime learning (19). For students, this leads to a reduced motivation to learn and a lack of self-learning abilities. In contrast, case analysis teaching is a student-centered strategy that allows students to learn actively (20). The case-based method encourages self-learning and patient-centered exploration of real and specific situations. In this mode, students examine specific cases, engage in independent learning and peer cooperation, and cultivate their critical thinking abilities and clinical problem-solving capacity (21). This teaching model provides a research model that combines content learning with practice. The results of our study showed that the students in the observation group demonstrated better mastery of the knowledge and greater self-learning and critical thinking capabilities. After case-based teaching, students' test scores were higher than those of students who had received other teaching methods, and the difference was statistically significant (MD =4.69, 95% CI: 0.96–8.42, P<0.00001).

In conclusion, compared with traditional teaching methods, case analysis teaching leads to better results in clinical anesthesia education and thus better prepares

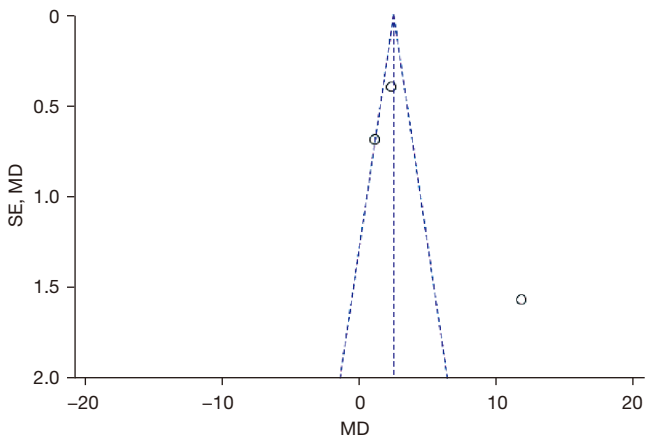

Figure 5 Funnel plot of theoretical test scores after anesthesia teaching. SE, standard error; ME, mean difference.

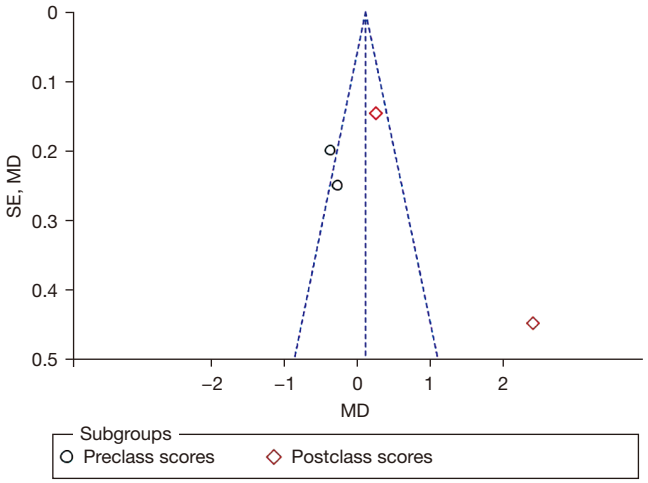

Figure 7 Funnel plot of pre- and post-class test scores. SE, standard error; ME, mean difference.

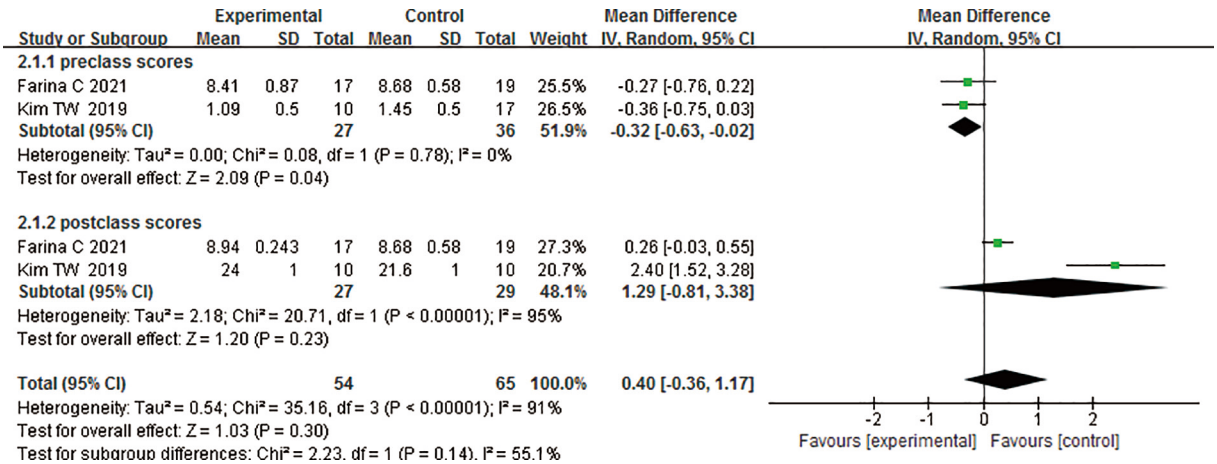

Figure 6 Forest plot of pre- and post-class test scores.

students for future clinical work.

Conclusions

This meta-analysis analyzed the impact of different teaching methods in 3 studies. The participants in the studies were divided into 2 groups, an observation group that used case analysis teaching and a control group that used other teaching methods. The test scores of the 2 groups were compared before and after teaching. The results showed that the case analysis teaching method is suitable for the teaching of clinical anesthesia and other subjects, which provides a scientific basis for the use of this method in anesthesia education.

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Footnote

Reporting Checklist: The authors have completed the PRISMA reporting checklist. Available at https://apm.amegroups.com/article/view/10.21037/apm-21-3832/rc

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://apm.amegroups.com/article/view/10.21037/apm-21-3832/coif). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are 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 and resolved

References

1. Curry SE. Teaching Medical Students Clinical Anesthesia. Anesth Analg 2018;126:1687-94.
2. Al-Dubbaisi H, Roy R, Patel VN, et al. Teaching Medical Students Clinical Anesthesia: A View From the United Kingdom. Anesth Analg 2018;127:e89-90.
3. Jones JL, Rinehart J, Spiegel JJ, et al. Teaching Tip: Development of Veterinary Anesthesia Simulations for Pre-Clinical Training: Design, Implementation, and Evaluation Based on Student Perspectives. J Vet Med Educ Summer;45:232-40.
4. Kary AL, Gomez J, Raffaelli SD, et al. Preclinical Local Anesthesia Education in Dental Schools: A Systematic Review. J Dent Educ 2018;82:1059-64.
5. Shah A, Mai CL, Shah R, et al. Simulation-Based Education and Team Training. Otolaryngol Clin North Am 2019;52:995-1003.
6. Baker K. Clinical teaching improves with resident evaluation and feedback. Anesthesiology 2010;113:693-703.
7. Smith C, Swain A, Penprase B. Congruence of perceived effective clinical teaching characteristics between students and preceptors of nurse anesthesia programs. AANA J 2011;79:S62-8.
8. Hartland W Jr, Londoner CA. Perceived importance of clinical teaching characteristics for nurse anesthesia clinical faculty. AANA J 1997;65:547-51.
9. Musk GC, Collins T, Hosgood G. Teaching Veterinary Anesthesia: A Survey-Based Evaluation of Two High-Fidelity Models and Live-Animal Experience for Undergraduate Veterinary Students. J Vet Med Educ Winter;44:590-602.
10. Slater RJ, Castanelli DJ, Barrington MJ. Learning and teaching motor skills in regional anesthesia: a different perspective. Reg Anesth Pain Med 2014;39:230-9.
11. Haydar B, Charnin J, Voepel-Lewis T, et al. Resident characterization of better-than- and worse-than-average clinical teaching. Anesthesiology 2014;120:120-8.
12. Struys MM, De Smet T, Mortier EP. Simulated drug administration: an emerging tool for teaching clinical pharmacology during anesthesiology training. Clin Pharmacol Ther 2008;84:170-4.
13. Chen XX, Trivedi V, AlSaflan AA, et al. Ultrasound-Guided Regional Anesthesia Simulation Training: A Systematic Review. Reg Anesth Pain Med 2017;42:741-50.

14. Wong G, Apthorpe HC, Ruiz K, et al. A Tale of Two Teaching Methods: Students' Clinical Perspectives on Administering Dental Local Anesthetics. J Dent Educ 2020;84:166-75.
15. Farina C, Hranchook AM, Bittinger AC, et al. The Flipped Classroom With Case-Based Learning in Graduate Nurse Anesthesia Education. AANA J 2021;89:254-60.
16. Kim TW, Singh S, Miller C, et al. Efficacy and Cost Comparison of Case-based Learning to Simulation-based Learning for Teaching Malignant Hyperthermia Concepts to Anesthesiology Residents. J Educ Perioper Med 2019;21:E631.
17. Bi M, Zhao Z, Yang J, et al. Comparison of case-based learning and traditional method in teaching postgraduate students of medical oncology. Med Teach 2019;41:1124-8.
18. Alamrani MH, Alammar KA, Alqahtani SS, et al. Comparing the Effects of Simulation-Based and Traditional Teaching Methods on the Critical Thinking Abilities and Self-Confidence of Nursing Students. J Nurs Res 2018;26:152-7.
19. Xie H, Liu L, Wang J, et al. The effectiveness of using non-traditional teaching methods to prepare student health care professionals for the delivery of mental state examination: a systematic review. JBI Database System Rev Implement Rep 2015;13:177-212.
20. Prastiyani NHN, Felaza E, Findyartini A. Exploration of constructive feedback practices in dental education chairside teaching: A case study. Eur J Dent Educ 2020;24:580-9.
21. Sharif-Chan B, Tankala D, Leong C, et al. An Observational Case Study of Near-peer Teaching in Medical and Pharmacy Experiential Training. Am J Pharm Educ 2016;80:114.

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