Med & Health Jul 2026; 21(2): 816-831 https://doi.org/10.17576/MH.2026.2102.15

ORIGINAL ARTICLE

Evaluating the Perception of Anaesthesiology Postgraduate Trainees on the Learning Environment in Operation Theatres in Malaysia

LAU CHIN[1], WAN RAHIZA WAN MAT[2]*, NOORJAHAN HANEEM MD HASHIM[3], NOOR AIRINI IBRAHIM[4], AZRINA MD RALIB[5], LAILA AB MUKMIN[6]

[1]*Department of Anaesthesiology & Critical Care, Hospital Tengku Ampuan Rahimah 41200 Klang, Selangor*
[2]*Department of Anaesthesiology & Intensive Care, Faculty of Medicine, Universiti Kebangsaan Malaysia, 56000 Cheras, Kuala Lumpur, Malaysia*
[3]*Department of Anaesthesiology, Faculty of Medicine, University of Malaya, 50603 Kuala Lumpur, Malaysia*
[4]*Department of Anaesthesiology & Intensive Care, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, 43400 Serdang, Selangor, Malaysia*
[5]*Department of Anaesthesiology, Kulliyyah of Medicine, International Islamic University Malaysia, 25200 Kuantan, Pahang, Malaysia*
[6]*Department of Anaesthesia, School of Medical Sciences, Universiti Sains Malaysia, 16150 Kubang Kerian, Kelantan, Malaysia*
**Correspondence: docaweng@yahoo.com; Tel: +603 91452783*

Received: 09 July 2025 / Accepted: 13 September 2025

ABSTRAK

Kajian keratan rentas prospektif ini menilai persepsi pelatih pascasiswazah anestesiologi terhadap persekitaran pembelajaran di dewan bedah (OT) di seluruh Malaysia menggunakan soal selidik 'Anaesthetic Trainee Theatre Educational Environment Measure' (ATEEM) yang divalidasikan. Instrumen ini terdiri daripada 40 item yang dikategorikan kepada lima domain. Data dianalisa menggunakan statistik deskriptif, 'ujian-t bebas dan Analisis Varians. Seramai 152 pelatih memberikan maklum balas (kadar maklum balas 52%). Purata skor keseluruhan ATEEM ialah 121.5 ± 21.9. Antara domain yang dinilai, "Persepsi Autonomi" menerima skor peratusan purata julat tertinggi (88.1%) manakala "Beban Kerja, Penyeliaan dan Sokongan" adalah yang terendah (65%). Pelatih lelaki melaporkan markah yang jauh lebih tinggi dalam domain "Peluang Pembelajaran dan Orientasi kepada Pembelajaran" (p = 0.034). Pelatih dari hospital bukan universiti yang bertauliah menganggap guru dan pengajaran mereka lebih baik berbanding pelatih dari hospital universiti (p = 0.040). Perbezaan ketara telah diperhatikan mengikut tahun latihan bagi beberapa item dalam domain "Atmosfera", "Beban Kerja/Penyeliaan/Sokongan" dan "Guru dan Pengajaran". Pelatih yang berasaskan universiti menyatakan ketidakpastian yang lebih tinggi mengenai item-item tertentu dalam domain yang sama, manakala tiada perbezaan yang ketara ditemui dalam domain "Autonomi" dan "Peluang Pembelajaran dan Orientasi kepada Pembelajaran". Perbandingan berpasangan post hoc turut dijalankan untuk item-item yang menunjukkan perbezaan signifikan. Secara keseluruhannya, persekitaran pembelajaran di OT dinilai secara positif. Walau bagaimanapun, kebimbangan telah dibangkitkan berkaitan beban kerja, suasana persekitaran dan kualiti pengajaran. Khususnya, persepsi positif terhadap kualiti pengajaran didapati merosot dalam kalangan pelatih yang beralih daripada hospital bukan universiti ke hospital universiti. Penemuan ini menekankan keperluan untuk mengkaji perbezaan antara institusi serta melaksanakan strategi yang bersasar bagi meningkatkan konsistensi dan kualiti pengalaman pembelajaran di OT.

Kata kunci: *Anaesthetic Trainee Theatre Education Environment Measure (ATEEM); bilik bedah (OT); persekitaran pembelajaran; pelatih lepasan siswazah anestesiologi*

ABSTRACT

This prospective cross-sectional study evaluated anaesthesiology postgraduate trainees' perceptions of the learning environment in operating theatres (OTs) across Malaysia using validated Anaesthetic Trainee Theatre Educational Environment Measure (ATEEM) questionnaire. The instrument comprised of 40 items categorised in five domains. Data were analysed using descriptive statistics, independent t-tests and Analysis of Variance. A total of 152 trainees responded (response rate 52%). The mean overall ATEEM score was 121.5 $\pm$ 21.9. Among the domains, "Perception of Autonomy" received the highest range average percentage score (88.1%) while "Workload, Supervision and Support" was the lowest (65%). Male trainees reported significantly higher scores in the "Learning Opportunities and Orientation to Learning" domain ($p = 0.034$). Trainees from accredited non-university hospitals perceived their teachers and teaching more favourably compared to those from university hospitals ($p = 0.040$). Significant differences were observed across years of training in selected items from the "Atmosphere", "Workload/ Supervision/Support" and "Teachers and Teaching" domains. University-based trainees expressed greater uncertainty regarding specific items within these same domains, while no significant differences were found in the "Autonomy" and "Learning Opportunities and Orientation to Learning" domains". Post hoc pairwise comparisons were conducted for significant items. Overall, the learning environment in OTs was perceived positively. However, concerns were raised regarding workload, atmosphere and quality of teaching. Notably, the positive perception of teaching declined among trainees transitioning from non-university to university hospitals. These findings underscore the need to examine institutional differences and implement targeted strategies to enhance the consistency and quality of the OT learning experience.
Keywords: Anaesthesiology postgraduate trainee; Anaesthetic Trainee Theatre Educational Environment Measure (ATEEM); learning environment, operation theatre

INTRODUCTION

The training and education to be anaesthesiologists mainly occurs in the operation theatre (OT), where knowledge and skills are acquired via practical experiences (Tanaka & Macario 2019). Teaching in anaesthesiology is challenging as it has to be practical and theoretical while working in the OT (Brown 2005). While playing the role of educators and trainers, anaesthesiologists' primary responsibility is their patients' safety during perioperative care (Bowe et al. 2018). In addition to the unique training environment, postgraduate trainees are also faced with other challenges including burnout from heavy clinical workload with psychological stress, inadequate mentoring and support (Bowe et al. 2018). Hence, a supportive and conducive educational environment is crucial to produce competent anaesthesiologists that cultivates learning-oriented attitude and behaviour (Hoff et al. 2004).

Several assessment tools that are available to evaluate the quality of educational environment. They are Dundee Ready Education Environment Measure (DREEM), Postgraduate Hospital Education Environment Measure (PHEEM), Surgical Theatre Education Environment Measure (STEEM) and Anaesthetic Trainee Theatre Educational Environment Measure (ATEEM) (Cassar 2004; Holt & Roff 2004; Roff et al. 1997; Roff et al. 2005). ATEEM was developed in New Zealand specifically to assess the perception of anaesthetic theatre learning environment among anaesthesiology residents (Holt & Roff 2004). This assessment tool encompasses five domains which are autonomy, perceptions of atmosphere, workload/supervision/support, perceptions of teachers and teaching and lastly learning opportunities and orientation to learning.

There are few studies that used ATEEM as an assessment tool to assess anaesthetics trainees' perception of their learning environment in the OT (Khan et al. 2021; Vongspanich et al. 2020; Wubshet et al. 2024; Zeb et al. 2017). There might be differences in perception of teachers

and teaching among trainees of different years, as suggested by Khan et al. (2021) in their study of 85 anaesthesiology trainees from University of Witwatersrand, which found the educational environment was perceived more positively by first- and fourth-year trainees. A study conducted in Pakistan had shown that perception differences in learning environment in OT exist among trainees of different institutions when comparison were made between public vs. private institutions (Zeb et al. 2017). Studies also had reported no significant differences in perceptions of learning environment in OT based on gender and age (Khan et al. 2021; Zeb et al. 2017). These previous studies described had small sample sizes, as the postgraduate trainees recruited were from one or two institutions.

Postgraduate anaesthesiology training in Malaysia is conjointly conducted by a few accredited universities. The administration of the program is by the National Anaesthesiology Specialist Committee which program head and coordinator of each university are a member of this committee. The duration of training is minimum 4 years, and it consists of clinical training, academic sessions and research project. For the first 2 years of postgraduate training, more trainees are trained at any accredited non-university hospitals compared to university hospitals. In their final 2 years of training, trainees are trained in their respective university hospitals. They are required to pass two examinations; the Part I Examination is held at the end of first year training while the Part II Examination is held at the end of fourth year training. To date, no study has evaluated the perceptions of anaesthesiology postgraduate trainees regarding their learning environment in the OTs in Malaysia. Addressing this gap is important to ensure that training programs remain supportive, consistent and aligned with international standards. Therefore, this study aimed to evaluate the perceptions of postgraduate training environment in the OT of various accredited non-university and university hospitals in Malaysia and compare their perceptions as they progress through the 4 years training.

MATERIALS AND METHODS

Study Design

This was a prospective, descriptive, cross-sectional multicentred study involving the anaesthesiology postgraduate trainees from all the universities that are part of the National Anaesthesiology Specialist Committee. The study duration was between 1st of June 2022 to 1st of December 2022.

Study Population

The eligible participants were registered postgraduate trainees of Universiti Kebangsaan Malaysia (UKM), Universiti Malaya (UM), Universiti Sains Malaysia (USM), Universiti Putra Malaysia (UPM) and International Islamic University Malaysia (IIUM), who were in their first to fourth year of training. Postgraduate trainees who had only been in the program for less than 3 months were excluded.

Materials

Permission from the original developers of ATEEM questionnaire were obtained prior to its use in this study. Holt and Roff (2004) developed this questionnaire intended to measure the anaesthesiology postgraduate trainees' perception of their learning environment in the OTs. The questionnaire underwent validation processes. Initially a pilot test was conducted among 12 anaesthetic trainees to evaluate the importance of each 156 inventory items. As a result, 43 items were perceived as highly important to be included into ATEEM for evaluation of anaesthetic educational environment in OTs. These items were refined by three anaesthetic educational supervisors to 40 items by removing repetitions and rephrasing. Subsequently, statistical factor analysis and face validity were performed using qualitative analyses leading to five domains as described below. They showed that ATEEM could potentially diagnosed problem areas in their training programme based on the variation detected in trainees' perception of their

educational environment in the OTs (Holt & Roff 2004).

The questionnaire consisted of 40 items categorised into five domains, namely Autonomy (8 items), Perception of Atmosphere (10 items), Workload/Supervision/Support (7 items), Perceptions of Teachers and Teaching (5 items) and Learning Opportunities and Orientation to Learning (10 items). Each item was rated by respondents using 5-point Likert scale consisting of the points namely "Strongly agree" (score 4), "Agree" (score 3), "Unsure" (score 2), "Disagree" (score 1) and "Strongly disagree" (score 0). The sum of Likert scale chosen by the respondents of the 40 items gave a total score that indicated the rating of the anaesthesia learning environment in the OTs. It was rated as very poor when the total scores were between zero to 40; many problems when the total scores were between 41 to 80; "more positive than negative" when the total scores were between 81 and 120; excellent when the total scores were between 121 and 160. In our study, to ease accessibility and compliance to complete the questionnaire, we converted the ATEEM questionnaire to an electronic version using the online Google Form without changing any content and component of the questionnaire.

Data Collection

Postgraduate trainees were invited to participate in this study via a standardised invitation email that contained the soft copy of the participant information sheet and the Google form link of the ATEEM questionnaire. In the email, the contact information of the investigators was made available if the postgraduate trainees had any queries to clarify.

At the start of the online self-administered ATEEM questionnaire, participants were informed that by proceeding, completing and submitting the online questionnaire anonymously, the investigators considered consents were provided by them to participate in this study. This method of obtaining informed consent was approved by the Research Ethics Committee. Following the first invitation email, the postgraduate trainees were given three weeks to consider participating in this study before one reminder email was sent to invite them to consider participating again.

Sample Size

The sample size was calculated by comparing two means by setting the value as 0.05 and power of study at 80%., in which the formula was as below:

$$n = 2\ \sigma^2 \div \Delta^2 \times (z_\alpha + z_\beta)^2$$

n = number of samples for each group
z_α = 1.96 (for α 0.05, 95% confidence interval)
z_β = 0.84 (80% power of study)
σ = population standard deviation
Δ = mean difference of two groups

Calculation was derived from mean maximum and minimum ATEEM scores and standard deviations (SD) as quoted in Khan et al. (2021), in which σ = 14.3; Δ = 11.2. Hence, minimum number of anaesthesiology postgraduate trainees that should be recruited per training year were 28 (25 x 4 plus 10% dropout rate) giving a total minimum number of trainees to be recruited into the study was 112.

Statistical Analysis

The data collected were analysed using Statistical Package for the Social Sciences (SPSS), version 19 (IBM Corp., Armonk, NY, USA). Demographic data and total ATEEM scores were analysed using descriptive statistics, which were reported in the form of frequency, percentage, mean and SD. Independent t-test and one-way Analysis of Variance (ANOVA) were used to explore the differences in ATEEM score, ATEEM subdomain scores and individual item scores of each domain among different years of training, type of hospitals and gender. Statistical significance was inferred at $p<0.05$. The instrument reliability was also measured using Cronbach's alpha coefficient. A Cronbach's alpha of between 0.65 and 0.8 or higher was considered as an acceptable internal reliability measurement.

RESULTS

The invitation emails were sent to 290 postgraduate trainees of which 152 responded, indicating 52% response rate. The Cronbach's alpha for ATEEM questionnaire was 0.95, indicating that this instrument had excellent internal reliability among the respondents in this study. Demographic distribution of the respondents was shown in Table 1. There was no significant association between gender and years of training. The respondents were significantly more from the accredited non-university hospitals who were mainly in their first or second year of training. Respondents from third and fourth years of training had higher proportion in university hospitals. No significant difference in ATEEM mean scores were observed between gender, years of training and type of training hospital.

The overall mean ATEEM score was normally distributed with mean ± SD of 121.5 ± 21.9. The maximum and minimum overall ATEEM scores were 160 and 45 respectively, indicating the perception range from "many problems" to "excellent". Figure 1 showed that most of the trainees' perception of the learning environment in OT was excellent and no one perceived it as very poor. Many trainees perceived the anaesthesia training in the OT as more positive than negative and a few of trainees perceived it as many problems.

The perception of the trainees towards each domain concerning the learning environment in OT was shown in Table 2. The perception domain that had the highest mean score percentage was autonomy whilst workload/supervision/support domain was the lowest.

Comparison of the mean scores of each of the five domains of ATEEM between gender, different years of training and type of training hospitals was shown in Table 3. Male postgraduate trainees had significantly better perception about the learning opportunities and orientation to learning in OT (p = 0.034). Postgraduate trainees who were trained in the accredited non-university hospitals had significantly better perception of their teachers and teaching in OT when compared to university hospitals (p = 0.040).

Table 4 showed the comparison of mean score of each ATEEM item between years and types of hospital of training. When comparing

TABLE 1: Demographic, years of training and types of training hospital of the respondents. Comparison of Anaesthetic Trainee Theatre Educational Environment Measure scores between respondents' genders, years of training and types of training hospital. Values were expressed as numbers and per-centages in paratheses.

Parameters, n (%)	Years of postgraduate training, n (%)				p-value	ATEEM mean score ± SD	p-value
	Year I 36 (23.7)	**Year II 39 (25.7)**	**Year III 36 (23.7)**	**Year IV 41 (27.0)**			
Gender							
Male, 52 (34.2)	10 (19.2)	18 (34.6)	12 (23.1)	12 (23.1)	0.309	125.44 ± 20.67	0.111
Female, 100 (65.8)	26 (26.0)	21 (21.0)	24 (24.0)	29 (29.0)		119.45 ± 22.47	
Type of hospital							
University hospital 62 (40.8)	1 (2.8)	2 (5.1)	28 (77.8)	31 (75.6)	<0.001	119.13 ± 22.47	0.271
Accredited Non-university hospital 90 (59.2)	35 (97.2)	37 (94.9)	8 (22.2)	10 (24.4)		123.13 ± 19.83	
ATEEM mean score ± SD	121.44 ± 20.51	122.49 ± 19.25	116.72 ± 25.12	124.80 ± 22.81	0.443		

ATEEM: Anaesthetic Trainee Theatre Educational Environment Measure; SD: Standard deviation

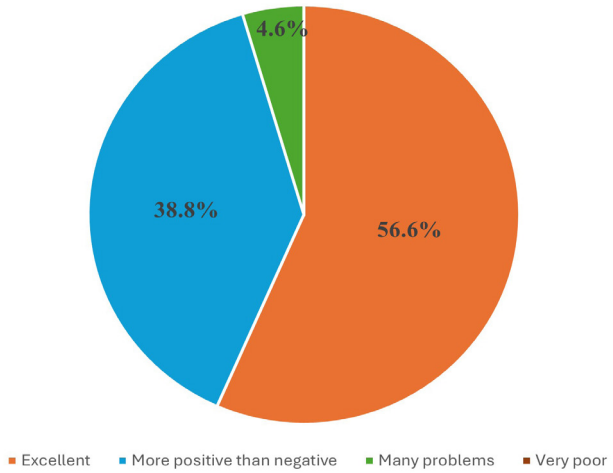

FIGURE 1: Percentage distribution of postgraduate trainees for each scale of perception

the items with years of training, three items were found significant. The items were number 4 in the "Perception of Atmosphere" domain, number 1 in the "Perception of Workload/Supervision/ Support" domain and number 4 in the "Perceptions of Teachers and Teaching" domain. When comparing the items with types of training hospital, seven items were significant. The items were numbers 4 and 5 in the "Perception of Atmosphere" domain, numbers 2 and 7 in the "Perception of Workload/Supervision/ Support" domain and numbers 3, 4 and 5 in the "Perceptions of Teachers and Teaching" domain. No significant differences were detected in the domains of "Perception of Autonomy" and "Perception of Learning Opportunities and Orientation to Learning".

Post hoc analyses were performed using pairwise comparisons of the ATEEM items that were significant when comparisons were made between years of training as shown in Table 5a, 5b and 5c. Significant perception differences were detected among third year trainees being unsure for the item "I have good collaboration with theatre staff" when compared to first- and second-year trainees. First year trainees significantly disagreed with the item "My workload in this job is fine" when compared

TABLE 2: Total mean score for each Anaesthetic Trainee Theatre Educational Environment Measure domain

Domain	Total mean score ± SD	Maximum score	Mean score percentage (%)
Autonomy	28.2 ± 3.3	32	88.1
Atmosphere	30.3 ± 6.3	44	68.9
Workload/Supervision/Support	18.2 ± 5.2	28	65.0
Teachers and teaching	15.2 ± 3.9	20	76.0
Learning opportunities and orientation to learning	29.7 7.0	40	74.2

SD: Standard deviation

TABLE 3: Comparison of the mean scores of each of the five domains of Anaesthetic Trainee Theatre Educational Environment Measure between gender, different years of training and type of hospitals.

	Autonomy score Mean ± SD	*p*-value	Atmosphere score Mean ± SD	*p*-value	Workload score Mean ± SD	*p*-value	Teaching score Mean ± SD	p-value	Learning score Mean ± SD	p-value
Gender										
Male	27.83 ± 3.54	0.373	31.38 ± 5.71	0.132	19.17 ± 4.65	0.095	16.06 ± 3.69	0.062	31.38 ± 6.32	0.034
Female	28.33 ± 3.17		29.77 ± 6.49		17.68 ± 5.46		14.81 ± 3.97		28.86 ± 7.2	
Years of training										
Year I	28.36 ± 2.72		30.50 ± 5.68		19.17 ± 4.65		16.06 ± 3.69		29.53 ± 7.71	
Year II	27.59 ± 3.91	0.555	30.82 ± 5.07	0.668	17.68 ± 5.46	0.338	14.81 ± 3.97	0.181	29.62 ± 6.82	0.240
Year III	28.06 ± 3.28		29.19 ± 7.40		19.17 ± 4.65		16.06 ± 3.69		28.14 ± 6.61	
Year IV	28.61 ± 3.29		30.68 ± 6.78		17.68 ± 5.46		14.81 ± 3.97		31.39 ± 6.70	
Type of hospital										
A	28.20 ± 3.21	0.850	30.76 ± 5.47	0.306	18.44 ± 4.90	0.473	15.78 ± 3.49	0.040	30.18 ± 6.80	0.336
B	28.10 ± 3.44		29.69 ± 7.27		17.82 ± 5.70		14.45 ± 4.37		29.06 ± 7.26	

SD: Standard deviation; A: Accredited non-university hospitals; B: University hospital

TABLE 4: Comparison of mean score of each Anaesthetic Trainee Theatre Educational Environment Measure item among different years of training and type of hospitals.

DOMAIN	Training year, Mean ± SD				p-value	Type of hospital		*p*-value
	I	II	III	IV		A	B	
PERCEPTION OF AUTONOMY								
1. I am encouraged to participate in the theatre setting.	3.64 ± 0.59	3.62 ± 0.54	3.47 ± 0.70	3.76 ± 0.44	0.193	3.63 ± 0.55	3.61 ± 0.61	0.830
2. I am encouraged to visit patients pre-operatively.	3.67 ± 0.59	3.49 ± 0.72	3.67 ± 0.76	3.63 ± 0.54	0.580	3.57 ± 0.65	3.68 ± 0.65	0.305
3. I discuss the anaesthetic plan of cases with the theatre teacher.	3.78 ± 0.59	3.46 ± 0.82	3.72 ± 0.57	3.63 ± 0.77	0.225	3.66 ± 0.69	3.63 ± 0.73	0.820
4. I am clear about the learning objectives of the theatre teaching session.	3.11 ± 0.85	3.08 ± 0.90	3.14 ± 0.80	3.32 ± 0.79	0.579	3.16 ± 0.82	3.18 ± 0.86	0.874

Continued...

...continuing

DOMAIN	Training year, Mean ± SD				p-value	Type of hospital		p-value
	I	II	III	IV		A	B	
5. I have an appropriate level of clinical responsibility.	3.69 ± 0.53	3.44 ± 0.68	3.64 ± 0.49	3.71 ± 0.46	0.107	3.60 ± 0.58	3.65 ± 0.52	0.621
6. I feel responsible and accountable for the care given to my patients.	3.89 ± 0.32	3.72 ± 0.46	3.81 ± 0.40	3.88 ± 0.33	0.179	3.82 ± 0.38	3.82 ± 0.39	0.996
7. I am aware of my anaesthetic role in theatre.	3.83 ± 0.38	3.72 ± 0.46	3.67 ± 0.54	3.85 ± 0.36	0.187	3.77 ± 0.45	3.77 ± 0.42	0.917
8. Teaching is done at appropriate times not affecting vigilance.	2.78 ± 1.15	3.08 ± 0.87	2.94 ± 1.01	2.83 ± 1.05	0.587	3.01 ± 0.98	2.70 ± 1.07	0.133
PERCEPTION OF ATMOSPHERE								
1. I feel comfortable in theatre socially.	3.22 ± 0.80	3.08 ± 0.77	2.97 ± 0.94	3.07 ± 0.99	0.688	3.20 ± 0.80	2.92 ± 0.96	0.052
2. I feel able to ask the questions I want.	3.08 ± 0.84	2.92 ± 0.90	2.97 ± 0.94	3.05 ± 0.97	0.870	3.08 ± 0.84	2.90 ± 1.00	0.246
3. My clinical teachers have established good rapport with me.	3.19 ± 0.79	3.36 ± 0.67	3.08 ± 0.73	3.24 ± 0.86	0.477	3.29 ± 0.72	3.13 ± 0.82	0.207
4. I have good collaboration with theatre staff.	3.39 ± 0.60	3.31 ± 0.66	2.81 ± 0.98	3.20 ± 0.90	0.012	3.32 ± 0.68	2.97 ± 0.96	0.009
5. I feel part of a team working here.	3.19 ± 0.82	3.31 ± 0.57	2.83 ± 1.08	3.12 ± 0.95	0.121	3.28 ± 0.74	2.89 ± 1.03	0.007
6. There is sex discrimination in this post.	2.92 ± 1.34	3.26 ± 1.27	3.33 ± 0.99	3.00 ± 1.12	0.372	3.03 ± 1.31	3.26 ± 0.97	0.253
7. My clinical teachers promote an atmosphere of mutual respect.	3.00 ± 0.93	3.15 ± 0.67	2.83 ± 1.03	3.05 ± 0.92	0.477	3.08 ± 0.78	2.92 ± 1.03	0.283
8. The people I work with are friendly.	2.92 ± 0.81	3.15 ± 0.59	2.94 ± 0.83	3.07 ± 0.79	0.487	3.03 ± 0.71	3.02 ± 0.82	0.891
9. I experience friendly relations with my teachers in theatre.	3.00 ± 0.68	3.23 ± 0.63	3.06 ± 0.83	3.20 ± 0.87	0.498	3.14 ± 0.65	3.10 ± 0.90	0.704
10. Surgeons do not like the noise of theatre teaching.	2.58 ± 1.00	2.13 ± 1.20	2.36 ± 1.07	2.68 ± 1.04	0.109	2.30 ± 1.10	2.60 ± 1.06	0.144

Continued...

...continuing

DOMAIN	Training year, Mean ± SD				p-value	Type of hospital		p-value
	I	II	III	IV		A	B	
PERCEPTION OF WORKLOAD/SUPERVISION/SUPPORT								
1. My workload in this job is fine.	1.58 ± 1.30	2.44 ± 1.02	2.44 ± 1.08	2.56 ± 1.14	0.001	2.11 ± 1.24	2.48 ± 1.10	0.058
2. I receive the necessary clinical supervision.	3.00 ± 0.72	2.97 ± 0.78	2.58 ± 0.97	2.80 ± 0.90	0.135	2.96 ± 0.76	2.68 ± 0.95	0.048
3. Whenever I participate in formal educational programmes, I get relief from theatre duties.	1.81 ± 1.51	2.03 ± 1.16	1.81 ± 1.14	2.12 ± 1.21	0.605	2.00 ± 1.30	1.87 ± 1.19	0.535
4. At this hospital I have access to help from more experienced colleagues.	2.94 ± 0.98	2.95 ± 0.83	2.89 ± 0.98	3.12 ± 0.87	0.695	2.94 ± 0.94	3.03 ± 0.87	0.560
5. There is an informative anaesthetic trainee handbook.	2.14 ± 1.13	2.31 ± 1.13	2.03 ± 1.32	2.32 ± 1.08	0.652	2.31 ± 1.14	2.05 ± 1.18	0.170
6. My clinical teachers are accessible for advice.	3.11 ± 0.98	3.21 ± 0.62	2.78 ± 0.99	3.12 ± 0.87	0.164	3.11 ± 0.83	2.98 ± 0.95	0.382
7. I receive effective supervision from the clinical teachers.	2.97 ± 0.85	3.08 ± 0.77	2.69 ± 1.06	2.88 ± 0.84	0.293	3.03 ± 0.83	2.73 ± 0.94	0.035
PERCEPTIONS OF TEACHERS AND TEACHING								
1. My clinical teachers are clear in their teaching.	3.06 ± 0.86	3.15 ± 0.88	2.89 ± 0.79	3.10 ± 0.74	0.537	3.11 ± 0.84	2.97 ± 0.77	0.286
2. My clinical teachers are fair in their evaluations.	2.92 ± 0.84	3.08 ± 0.74	2.94 ± 0.83	3.10 ± 0.80	0.685	3.02 ± 0.79	3.00 ± 0.81	0.867
3. The clinical teachers in this hospital interact well with trainees.	3.17 ± 0.70	3.23 ± 0.71	2.78 ± 1.02	3.05 ± 0.81	0.088	3.18 ± 0.73	2.89 ± 0.93	0.032
4. The teacher helps to develop my competence.	3.28 ± 0.66	3.38 ± 0.88	2.78 ± 1.07	3.00 ± 1.03	0.023	3.29 ± 0.77	2.85 ± 1.11	0.005
5. The teaching helps to develop my confidence.	3.11 ± 0.79	3.21 ± 1.01	2.72 ± 1.06	2.95 ± 1.00	0.157	3.18 ± 0.83	2.74 ± 1.12	0.006

Continued...

...continuing

DOMAIN	Training year, Mean ± SD				p-value	Type of hospital		p-value
	I	II	III	IV		A	B	
PERCEPTION OF LEARNING OPPORTUNITIES AND ORIENTATION TO LEARNING								
1. Much of what I learn seems relevant to my career.	3.39 ± 0.69	3.49 ± 0.68	3.22 ± 0.80	3.56 ± 0.59	0.170	3.49 ± 0.66	3.32 ± 0.74	0.148
2. There is a systematic clinical training programme.	2.64 ± 1.05	2.54 ± 1.10	2.28 ± 1.21	2.73 ± 1.14	0.337	2.67 ± 1.08	2.39 ± 1.18	0.133
3. I have the opportunity for on-the-job learning.	3.03 ± 0.88	3.05 ± 0.89	2.92 ± 0.81	3.37 ± 0.62	0.082	3.09 ± 0.84	3.11 ± 0.77	0.858
4. I have the opportunity to acquire the appropriate practical procedures for my level of training (i.e. fibreoptic intubation/subtenons nerve block).	3.00 ± 1.10	3.00 ± 0.86	2.75 ± 0.97	3.27 ± 0.87	0.128	3.02 ± 0.97	3.00 ± 0.94	0.889
5. There is a clinical training programme here that allows me to get first-hand experience in a range of procedures.	3.03 ± 1.08	2.97 ± 0.87	2.89 ± 0.75	3.17 ± 0.83	0.561	3.03 ± 0.93	3.00 ± 0.83	0.820
6. There are good opportunities for trainees who fail to complete their training satisfactorily.	2.67 ± 1.01	2.38 ± 1.04	2.53 ± 0.91	2.78 ± 0.99	0.318	2.61 ± 1.00	2.56 ± 0.99	0.770
7. I am able to acquire adequate technical skills in this post.	3.03 ± 0.88	3.00 ± 0.86	2.86 ± 0.76	3.22 ± 0.76	0.286	3.09 ± 0.79	2.95 ± 0.86	0.31
8. I have opportunities to learn and practise a variety of clinical procedures.	3.11 ± 0.98	3.21 ± 0.83	2.94 ± 0.67	3.27 ± 0.67	0.319	3.21 ± 0.80	3.03 ± 0.79	0.175
9. I receive theatre teaching in anaesthetic specialty areas targets on my learning needs.	2.83 ± 1.00	3.00 ± 0.97	2.86 ± 0.76	2.95 ± 0.95	0.851	2.98 ± 0.87	2.82 ± 0.98	0.308
10. There are opportunities for learning all desired clinical skills.	2.81 ± 1.11	2.97 ± 0.96	2.89 ± 0.75	3.07 ± 0.88	0.629	2.99 ± 0.95	2.87 ± 0.90	0.444

Score for each item was rated using Likert scale of 0 to 4: 0 (Strongly disagree), 1 (Disagree), 2 (Unsure), 3 (Agree), 4 (Strongly Agree)
A: Accredited non-university hospitals; B: University hospitals.

to the other respondents in the various years of training. Third year trainees significantly scored lower than second year trainees regarding item "The teacher helps to develop my competence".

DISCUSSION

The response rate in our study is considered acceptable as existing literature reported the average response rate of online surveys in educational research was 44% (Wu et al. 2022). A minimum response rate of 50% is generally regarded as acceptable (Babbie 1990). Based on the overall mean ATEEM score, our study found that most of the trainees had good perceptions towards the anaesthetic educational environment in OT. Autonomy was observed to be the highest scoring domain in our study which similarly was shown in studies done in South Africa and Iran (Khan et al. 2021; Koohpayehzadeh et al. 2019). Malaysian trainees perceived that they have control over and involved in their education in OT whilst South African trainees were assigned high level of responsibility and accountability for their patient care (Khan et al. 2021). The domain "Workload/Supervision/Support" were scored the least among the trainees reflecting their perception regarding this domain influencing their anaesthetic education in OT as also reported in the South African and Iran study (Khan et al. 2021; Koohpayehzadeh et al. 2019). To explore this issue further, our study made in-depth analyses into each item's score in this domain.

We found there was a shift in the trainees' perspective regarding their perception towards their workload, as first-year trainees disagree with the statement "My workload in this job is fine" whilst second, third and fourth-year trainees were uncertain about this statement. We included first year trainees who had been in the program for at least 6 months. Thus, when they responded to the questionnaire, they would have been in their second semester of their first year of training. It is possible that first-year trainees were still adjusting to the training programme and coping with the challenges of relocation

TABLE 5(a): Post hoc pairwise comparison for the item number 4 in the "Perception of Atmosphere" domain

(I) Year of training	(J) Year of training	Mean Difference (I-J)	Standard Error	95% Confidence Interval		p-value
				Lower Bound	Upper Bound	
Year I	Year II	0.081	0.185	-0.41	0.58	1.000
	Year III	0.583	0.189	0.08	1.09	0.014
	Year IV	0.194	0.183	-0.30	0.68	1.000
Year II	Year I	-0.081	0.185	-0.58	0.41	1.000
	Year III	0.502	0.185	0.01	1.00	0.045
	Year IV	0.113	0.179	-0.37	0.59	1.000
Year III	Year I	-0.583	0.189	-1.09	-0.08	0.014
	Year II	-0.502	0.185	-1.00	-0.01	0.045
	Year IV	-0.390	0.183	-0.88	0.10	0.209
Year IV	Year I	-0.194	0.183	-0.68	0.30	1.000
	Year II	-0.113	0.179	-0.59	0.37	1.000
	Year III	0.390	0.183	-0.10	0.88	0.209

TABLE 5(b): Post hoc pairwise comparison for the item number 1 in the "Perception of Workload/ Supervision/Support" domain

(I) Year of training	(J) Year of training	Mean Difference (I-J)	Standard Error	95% Confidence Interval		p-value
				Lower Bound	Upper Bound	
Year I	Year II	-0.880	0.263	-1.58	-0.18	0.006
	Year III	-0.889	0.268	-1.61	-0.17	0.007
	Year IV	-1.005	0.260	-1.70	-0.31	0.001
Year II	Year I	0.880	0.263	0.18	1.58	0.006
	Year III	-0.009	0.263	-0.71	0.69	1.000
	Year IV	-0.125	0.254	-0.81	0.56	1.000
Year III	Year I	0.889	0.268	0.17	1.61	0.007
	Year II	0.009	0.263	-0.69	0.71	1.000
	Year IV	-0.117	0.260	-0.81	0.58	1.000
Year IV	Year I	1.005	0.260	0.31	1.70	0.001
	Year II	0.125	0.254	-0.56	0.81	1.000
	Year III	0.117	0.260	-0.58	0.81	1.000

TABLE 5(c): Post hoc pairwise comparison for the item number 4 in the "Perception of Teachers and Teaching" domain

(I) Year of training	(J) Year of training	Mean Difference (I-J)	Standard Error	95% Confidence Interval		p-value
				Lower Bound	Upper Bound	
Year I	Year II	-0.107	0.214	-0.68	0.46	1.000
	Year III	0.500	0.218	-0.08	1.08	0.140
	Year IV	0.278	0.211	-0.29	0.84	1.000
Year II	Year I	0.107	0.214	-0.46	0.68	1.000
	Year III	0.607	0.214	0.04	1.18	0.031
	Year IV	0.385	0.207	-0.17	0.94	0.390
Year III	Year I	-0.500	0.218	-1.08	0.08	0.140
	Year II	-0.607	0.214	-1.18	-0.04	0.031
	Year IV	-0.222	0.211	-0.79	0.34	1.000
Year IV	Year I	-0.278	0.211	-0.84	0.29	1.000
	Year II	-0.385	0.207	-0.94	0.17	0.390
	Year III	0.222	0.211	-0.34	0.79	1.000

and upcoming examinations. This plausible explanation, while not directly measured in our study, is consistent with findings from other educational research indicating that transitions and examination-related stress can influence perceptions of workload and support (Wu et al. 2022). They could still be adjusting to being in the training program and some still trying to settle down after being relocated to accredited training hospitals when they enrolled into the program. Furthermore, they would have been trying to cope with the challenges of preparing to sit for their Part I examinations at the end of semester. The adjustment and coping ability likely improved as they progressed to the final year as reflected by the scores for this item in increasing years of training. Apart from workload, based on the mean item score rated, trainees also expressed either uncertainty or disagreement that they could get relief from theatre duties when they needed to participate in formal educational programs. Similarly, in the South African study they observed the same occurrence, and they attributed it to their high patient load and shortage of manpower in their hospitals, which may be the same in our situation (Khan et al. 2021). This aspect can be improved, and our training program will have to explore the reasons for this incidence.

Respondents of this study were significantly more from the accredited non-university hospitals which were mostly in their first and second years of training which could be contributing to the better perception of teachers and teaching observed when compared to those in university hospitals. The difference could be attributed to a few possibilities. Firstly, in Malaysia, accredited non-university hospitals are the training locations for first- and second-year trainees. As they are in their first half of training, they are expected to receive more guidance and teaching sessions from the trainers. As training progressed into third and fourth years, they are expected to perform their duties in the OT independently most of the times with trainers nearby. Furthermore, third year trainees who are transitioning to the level of reduced supervised training also have the challenges of relocating from accredited non-university hospitals to university hospitals. Expectations of them would be higher with more responsibilities and making independent clinical decisions in OT. The impact of such transition was discernible when comparing second- and third-year trainees' perception for the item "the teacher helps to develop my competence", in which second year trainees agreed with this statement, but third year trainees were somehow doubtful. Moreover, the bulk of research activities which are part of the training program mainly takes place during last two years of training, adding more challenges for the trainers in university hospitals in guiding the trainees (Khan et al. 2021).

The anaesthesiology training program not only revolves around theoretical knowledge but also important technical skills and the experiences of doing various clinical procedures. Competition among trainees perhaps was inevitable when it comes to getting the opportunities of hands-on experiences in a range of procedures. In this context, it was interesting to note that male trainees had a better perception of their learning opportunities and orientation to learning in the OT compared to female trainees. The reasons for this discrepancy were not determined in this study. A study about the gender effects in anaesthesia training revealed male trainees were more confident than female trainees in performing procedures and the female trainees also perceived that their gender had negatively impacted on how they were being treated in anaesthesia training (Pearce et al. 2020). Besides, another study that assessed the learning environment of OTs for medical interns also noted fewer positive perceptions of female interns in learning opportunities (Al-Qahtani & Al-Sheikh 2012).

Our study detected the perceptions of uncertainties expressed by trainees in the university hospitals concerning several items in the domains of "atmosphere", "workload/supervision/support" and "teachers and teaching" which indicate a dire need of improvements to be implemented in OTs of university hospitals by investigating and addressing the causes of

these uncertainties. The items were related to collaboration and teamwork between trainees and staff, necessary and effective clinical supervision by clinical teachers, having good interaction with the trainees, and assisting in developing competence and confidence of the trainees by the teachers. Collaborative and teamwork dynamics can be a bigger challenge in university hospitals having multidisciplinary teams that also consists of postgraduate trainees from various disciplines co-managing the patients in OTs, where cohesiveness may not readily be achieved (Gillespie et al. 2010). It is worth noting that, in general, trainees located in the university hospitals were mainly third- and fourth-year trainees. Thus, higher expectations are placed on the senior trainees in addition to increased responsibility, reduced direct supervision, and greater accountability, may explain why university-based trainees expressed uncertainty in these domains, a phenomenon also described in other studies of transition into clinical practice (Farnan et al. 2012; Prince et al. 2005). Nevertheless, the university hospitals will have to evaluate further the "atmosphere" in the OTs to improve this perception.

The clinical relevance of these findings lies in the strong association between the quality of the educational environment and the development of competent, confident anaesthesiologists. Prior research had shown that supportive learning environments facilitate professional growth and clinical competence (Flott & Linden 2016), while adequate supervision was directly linked to improved patient safety and trainee performance (Farnan et al. 2012). Conversely, excessive workload and insufficient support contributed to stress and burnout among residents, with potential downstream effects on learning efficiency and patient care (Thomas 2004). Furthermore, positive learning environments were associated with stronger teamwork and safety culture within operating theatres (Gillespie et al. 2010). These findings emphasised that efforts to strengthen the OT learning environment may have broader implications not only for postgraduate training but also for patient outcomes and healthcare delivery.

To the best of our knowledge, this is the first study to examine the perceptions of anaesthesiology postgraduate trainees on the OT learning environment in Malaysia. The findings therefore provide unique baseline data that can guide local postgraduate training reforms and also contribute to regional and global discussions on optimising anaesthesia education. Training programmes could consider implementing structured mentorship during transition phases (from non-university to university hospitals), optimising workload distribution to allow participation in formal teaching and standardising supervision practices across institutions. These targeted strategies may enhance the consistency and quality of postgraduate anaesthesiology training in Malaysia. A recent scoping review highlight that feedback processes in anaesthesia education are multifactorial and context-specific (Patel & Dexter 2025), while simulation-based training shows promising outcomes in enhancing trainee competence and perception of the learning environment (Ashokka et al. 2024). Moreover, factors impacting OT learning dynamics, such as support and supervisory relationships, have been described in nursing anaesthesia contexts (Hedlund et al. 2024), offering transferable insights for anaesthesiology training programs. Future studies may explore these issues further using qualitative methodologies, such as interviews or focus groups, to understand in greater depth the lived experiences of trainees and educators. Longitudinal research following cohorts across training years, as well as interventional studies evaluating the effectiveness of mentorship or workload adjustments, would provide stronger evidence for shaping future training policies.

Our study has a few limitations. The ATEEM instrument was used to assess the trainees' perceptions of the educational environment in OTs. To be holistic in assessing the anaesthetic educational environment in OTs, the perspectives of the educators should also be evaluated to reflect the true picture of the quality of anaesthesia training in Malaysia. Besides, this study was contextual to the anaesthesiology trainees

registered under selected public universities, and hence the results may not be generalised to trainees of other programs. In addition, our study did not investigate further why there is a gender difference in perception of learning opportunities and orientation to learning and hence this is an area for further study in the future.

CONCLUSION

The overall perception of our postgraduate trainees regarding the anaesthetic educational environment in OT was good. Nevertheless, there were still dissatisfaction and uncertainties expressed over certain aspects related to workload, atmospheres, teachers and teaching. The positive perception that trainees had for their teachers and teaching diminished as trainees' workplace transitioned from accredited non-university to university hospitals. These findings have important implications for training programs, underscoring the need for structured support during transitions, consistent supervisory practices and attention to workload balance. Future work should expand on these findings through qualitative and longitudinal research to inform evidence-based improvements in postgraduate anaesthesiology training.

Author contributions: Conceived the study: WRWM, NHMH, NAI, AMR, LAM; Study design and methodology: LC, WRWM; Study resources: WRWM, NHMH, NAI, AMR, LAM; Data collection and analysis: LC; Writing-original draft: LC, WRWM; Writing-review and editing: WRWM, NHMH, NAI, AMR, LAM; Supervision: WRWM. All authors have approved the final manuscript.

Funding: No funding was received for the study.

Acknowledgement: The authors appreciate the assistance provided by all the heads of the postgraduate programs involved in the National Speciality Committee (Anaesthesiology) in assisting to distribute the ATEEM questionnaires to their postgraduate trainees.

Conflict of interest: The authors declare no conflicts of interest.

Ethics statement: Ethic approval was obtained from the UKM Research Ethics Committee (JEP-2022-412) before conducting this study.

REFERENCES

Al-Qahtani, M.F., Al-Sheikh, M. 2012. Assessment of educational environment of surgical theatre at a teaching hospital of a Saudi University: Using surgical theatre educational environment Measures. *Oman Med J* **27**(3): 217-23. https://doi.org/10.5001/omj.2012.49

Ashokka, B., Liu, Y., Sng, B.L., Ti, L.K. 2024. Educational outcomes of simulation-based training modalities in regional anaesthesia: A systematic review. *Br J Anaesth* **133**(6): 1005-18. https://doi.org/10.1016/j.bja.2024.07.037

Babbie, E. 1990. Survey Research methods. California: Wadsworth.

Bowe, E.A., Schell, R.M., DiLorenzo, A.N. 2018. Education in anesthesia, how to deliver the best learning experience. United Kingdom: Cambridge University Press.

Cassar, K. 2004. Development of an instrument to measure the surgical operating theatre learning environment as perceived by basic surgical trainees. *Med Teach* **26**(3): 260-4. https://doi.org/10.1080/0142159042000191975

Flott, E.A., Linden, L. 2016. The clinical learning environment in nursing education: A concept analysis. *J Adv Nurs* **72**(3): 501-13. https://doi.org/10.1111/jan.12861

Farnan, J.M., Petty, L.A., Georgitis, E., Martin, S., Chiu, E., Prochaska, M., Arora, V.M. 2012. A systematic review: The effect of clinical supervision on patient and trainee outcomes in postgraduate medical education. *Acad Med* **87**(4): 428-42. https://doi.org/10.1097/ACM.0b013e31824822cc

Gillespie, B.M., Chaboyer, W., Murray, P. 2010. Enhancing communication in surgery through team training interventions: A systematic literature review. *AORN J* **92**(6): 642-57. https://doi.org/10.1016/j.aorn.2010.02.015

Hedlund, J., Blomberg, K., Hjelmqvist, H., Jaensson, M. 2024. Student nurse anesthetists' and supervisors' perspectives of learning in the operating room: An integrative review. *J Perianesth Nurs* **39**(2): 303-10.e8. https://doi.org/10.1016/j.jopan.2023.07.023

Hoff, T.J., Pohl, H., Bartfield, J. 2004. Creating a learning environment to produce competent residents: The roles of culture and context. *Acad Med* **79**(6): 532-9. https://doi.org/10.1097/00001888-200406000-00007

Holt, M.C., Roff, S. 2004. Development and validation of the Anaesthetic Theatre Educational Environment Measure (ATEEM). *Med Teach* **26**(6): 553-8. https://doi.org/10.1080/01421590410001711599

Khan, S., Scribante, J., Perrie, H., Green-Thompson, L. 2021. Evaluation of the anaesthetic theatre educational environment at the University of the Witwatersrand. *South Afr J Anaesth Analg* **27**(4): 186-91. https://doi.org/10.36303/SAJAA.2021.27.4.2605

Koohpayehzadeh, J., Mirzaei, Z., Zahedi, H., Alebouyeh, M.R., Naghizadeh Moogari, Z. 2019. Psychometric properties of the Persian version of the Anesthetic Trainee Theatre Educational Environment Measure (ATEEM). *Med J Islam Repub Iran* **33**: 13. https://doi.org/10.34171/mjiri.33.13

Patel, S., Dexter, F. 2025. A scoping review of feedback features during clinical education for anaesthesia trainees. *Indian J Anaesth* **69**(5): 450-7. https://doi.org/10.4103/ija.ija_1011_24

Pearce, G., Sidhu, N., Cavadino, A., Shrivathsa, A., Seglenieks, R. 2020. Gender effects in anaesthesia training in Australia and New Zealand. *Brit J Anaesth* **124**(3): e70-6. https://doi.org/10.1016/j.bja.2019.12.020

Prince, K.J., Boshuizen, H.P., van der Vleuten, C.P., Scherpbier, A.J. 2005. Students' opinions about their preparation for clinical practice. *Med Educ* **39**(7): 704-12. https://doi.org/10.1111/j.1365-2929.2005.02207.x

Roff, S., McAleer, S., Harden, R.M., Al-Qahtani, M., Ahmed, A.U., Deza, H., Groenen, G., Primparyon, P. 1997. Development and validation of the Dundee Ready Education Environment Measure (DREEM). *Med Teach* **19**(4): 295-9. https://doi.org/10.3109/01421599709034208

Roff, S., McAleer, S., Skinner, A. 2005. Development and validation of an instrument to measure the postgraduate clinical learning and teaching educational environment for hospital-based junior doctors in the UK. *Med Teach* **27**(4): 326-31. https://doi.org/10.1080/01421590500150874

Tanaka, P., Macario, A. 2019. Advances and challenges in postgraduate anesthesia education. *J Head Neck Anesth* **3**(1): e6-e6. https://doi.org/10.1097/HN9.0000000000000006

Thomas, N.K. 2004. Resident burnout. *JAMA* **292**(23): 2880-9. https://doi.org/10.1001/jama.292.23.2880

Vongspanich, W., Komonhirun, R., Srilumyai, S. 2020. Anesthesiology residents' perception towards educational environment using ATEEM in a medical school in Thailand. *Res Dev Med Educ* **9**(1): 16. https://doi.org/10.34172/rdme.2020.016

Brown, K. 2005. Teaching anaesthesia in the operating theatre. *Update in Anaesthesia*. World Federation of Societies of Anaesthesiologists https://resources.wfsahq.org/wp-content/uploads/uia-19-TEACHING-ANAESTHESIA-IN-THE-OPERATING-THEATRE.pdf [Accessed on 4March 2024]

Wu, M.J., Zhao, K., Fils-Aime, F. 2022. Response rates of online surveys in published research: A meta-analysis. *Comput Hum Behav Rep* **7**: 100206. https://doi.org/10.1016/j.chbr.2022.100206

Wubshet, T., Getahun, A., Ayele, A., Mekonnen, W., Workneh, B., Berhanu, Y. 2024. Perception of the operation theatre learning environment among undergraduate anaesthesia students in Ethiopia: A multicentre cross-sectional study. *BMC Med Educ* **24**: 303. https://doi.org/10.1186/s12909-024-05320-6

Zeb, H., Rehman, A., Niazi, A.U.K. 2017. Assessment of learning environment in anesthesia by using ATEEM tool. *Anaesth Pain Intensi* **21**(3): 354-359.