

ORIGINAL ARTICLE

Perception of Surgical Residents about Learning in Operation Theatres at CHICH Using STEEM

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ABSTRACT

Introduction: Educational environment or learning environment is a context in which teaching, training and grooming of post graduate residents occurs. Surgical specialty as a whole and operating rooms in particular are very important in terms of teaching and training. Perception of residents as to this learning environment is quite vital to their learning and should be assessed objectively to identify weak and strong areas of the environment. The Surgical Theatre Educational Environment Measures (STEEM) questionnaire is an instrument that can be used to assess perception of residents about learning environment in operation theatre.

Aim: To evaluate the perception of surgical post-graduate residents about their learning environment in operating rooms and compare this perception among different strata of residents with respect to age, gender, and year of residency.

Methods: This cross-sectional study was conducted at The Children's Hospital & The Institute of Child Health Lahore. STEEM questionnaire was used to check the perceptions of educational environment in surgical theatres. This study was carried out from July 2019 to September 2019. A total of 62 surgical residents were given printed questionnaire after informed consent. The data was analyzed through SPSS V24 and descriptive and inferential analyses performed.

Results: Out of 62 surgical residents, 61 responded (Response rate 98.3%). Mean age of residents was 29.27 years (± 2.37); 45 residents were male whereas 16 were females (2.8:1). Majority of residents were from 3rd (34.4%) and 4th (21.3%) year of their residency. The total mean score was 147.66 (± 18.57). No difference in mean scores were found as to age and sex of participants; whereas, responses were statistically more positive for residents in their first year or fifth year of their residency. Overall, 53 residents gave favorable/positive response.

Conclusion: Overall residents had good perception about their training and supervisors, learning opportunities in operation theatre, atmosphere in operation theatre, and supervision being provided to them.

Key words: STEEM, Surgical, Perception, Surgical residents, Learning environment, Operation theatre learning.

Introduction: Educational environment, also known as learning environment is a context in which teaching, training and learning of post graduate residents occurs. It also refers to an intricately woven network of working personnel with close interaction to bring positive impact of curriculum on both students and teachers (Kamran, Al-Eraky, Izhaar, & Anjum, 2018). The learning in all domains i.e. knowledge skill and attitude in the training institutes is crucial in attaining competence in their respective fields. The time to time critical analysis and evaluation of this educational environment makes

possible to bring out good role modeling and to improve the quality of medical education when and where needed. Surgical specialty as a whole and operating rooms in particular are very important in terms of their learning environment as different cases pose variable complexity of understanding.

Post-graduate surgical residents work in quite a stressed working atmosphere due to high patient burden and long working hours. Day by day increasing trauma has added in this patient number. This increased work load directly and indirectly has serious risks to patient safety as well as affects their learning (Roff et al., 1997).

Various methods known as scoring systems consisting of questionnaires have been used for evaluating various learning environments of under- as well as post-graduates like DREEM, OREEM, PHEEM, ATEEM, STEEM etc. Each tool has its own pros and cons and has been tested in various loco-regional settings (Kamine, Sabe, Nath, Barnes, & Kent, 2018).

STEEM was first developed in 2004 for surgical residents

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(Cassar, 2004). Later different studies were conducted using this as a template (Hexter, O'Dowd-Booth, & Hunter, 2019).

Internationally quite a number of studies for evaluating educational environment are available but in Pakistan very limited work has been done. Particularly the assessment on surgical floors despite being high pressure over-stressed specialty area, very sparse literature is available (Sandhu et al., 2018). This deficiency gave us the idea to conduct this study in surgical residents at The Children's Hospital Lahore, being the largest tertiary care hospital.

The study will help in identifying the weaknesses and deficiencies in learning environment for surgical residents at CHICH, Lahore. Based upon the results of this study, the teaching and training modalities may be modified according to their perception and level of satisfaction. The educational environment of surgical theatres will be improved by friendly atmosphere, mentorship, more time for hands-on practice, and equal opportunities to all residents.

This study was planned to evaluate the perception of surgical post-graduate residents about their learning environment in operating rooms and compare this perception among residents stratified by age, gender and year of residency.

Methods: This cross-sectional study was conducted among surgical post-graduate residents (PGRs) of The Children's Hospital & the Institute of Child Health, Lahore, from July 2019 to September 2019. The study was approved by Ethical Review Committee of Children Hospital and Institute of Child Health, Lahore. We included all the surgical residents working in all surgical units of Children Hospital and Institute of Child Health, Lahore. The form was administered to 62 surgical residents and all residents responded except 1. The sampling technique was simple purposive sampling. A formal consent was taken from the participants and anonymity of responses was assured to the residents.

Surgical Theatre Educational Environment Measure (STEEM) (Cassar, 2004) is a 40 item questionnaire, based on 5 point Likert scale (strongly agree=5, agree=4, uncertain=3, disagree=2, strongly disagree=1), previously validated and divided into four subscales: subscale 1: trainees' perceptions of their trainer and training (questions 1-13); subscale 2: trainees' perceptions of learning opportunities (questions 14-24); subscale 3: Trainees' perceptions of atmosphere in the operating theatre (questions 25-32); subscale 4: and trainees' perceptions of supervision, workload and support (questions 33-40). The minimum score was 40 and possible maximum score was 200. A score of at least 120 out of 200 was considered favorable. The value above 120 indicates a more satisfactory perception of educational

environment (Al-Qahtani & Al-Sheikh, 2012). Similarly, the cut off scores for positive or satisfactory perception for subscales 1,2,3, and 4 were 39, 33, 24, and 24, respectively.

The proformas were collected after one week. The data was analyzed with help of SPSS 24. Few Items with negative responses (8, 14, 19, 22, 23, 26, 27, 28, 30, 31, 33, 34, 35, 36, 37,28, 40) were reverse coded to keep the score in the positive direction. The reliability of the instrument was checked by Cronbach alpha coefficient. The descriptive statistics were described in mean, standard deviation, and frequencies. Inferential statistics including students t-test/ANOVA were calculated to find any significant differences in the mean scores based on age, gender, and level of training of the surgical residents. Spearman correlation was also calculated to find any association between various subscales of the questionnaire.

Results: A total of 61 out of 62 residents completed the questionnaire with a response rate of 98.3%. The mean age of residents was found as 29.27 ± 2.37 years. Of 61 respondents, 45 (73.8%) were males while 16 respondents (26.2%) were female with a male to female ratio of 2.8:1. According to year of training, most of our respondents were from 3rd year (21, 34.4%) followed by 4th year (13, 21.3%), 5th year (11, 18%), 2nd year (9, 14.8%), and 1st year (7, 11.5%) of their residency.

The overall Cronbach alpha of the STEEM instrument was highly reliable (0.908); while for subscale 1, 2, 3, and 4, it was 0.871, 0.781, 0.602, and 0.663, respectively. Spearman rho correlation was calculated for overall score as well as subscales and found positive correlation among all subscale scores and overall scores ("r" ranges from 3.94 to 8.93).

The overall/total mean score of STEEM questionnaire of all participants was 147.66 ± 18.57 (cut off 120) which reflect positive perception; similarly, mean score of each subscale was also satisfactory with respect to student's perception (Table 1). The overall mean score of all items was 3.69 ± 0.48 with minimum value of 2.42 and maximum value of 4.46. Table 2 gave mean score of each item along with standard deviation. In table 2, we have color coded the mean responses according to most positively scored and least positively scored items.

Table No. 1: STEEM Subscales and total score

SUB SCALE	Mean	Std. Deviation
Trainees' perceptions of their trainer and training	48.25	8.09
Trainees' perceptions of learning opportunities	41.92	5.82
Trainees' perceptions of the atmosphere in the operating theatre	28.33	4.19
Trainees' perceptions on Supervision, workload and Support	29.16	4.55
Total	147.66	18.57

Table 2: STEEM questionnaire and mean scores

Q: No.	Questions	Mean	SD
1	My trainer has a pleasant personality	3.95	0.902
2	I get on well with my trainer	3.74	1.047
3	My trainer is enthusiastic about teaching	4.26	0.814
4	My trainer has a genuine interest in my progress	3.97	0.948
5	I understand what my trainer is trying to teach me	4.02	0.764
6	My trainer's surgical skills are very good	4.46	0.535
7	My trainer gives me time to practice surgical skills in theatre	3.79	1.002
8	My trainer immediately takes the instruments away when I do not perform well	*3.57	1.056
9	Before the operation my trainer discusses the surgical technique planned	3.05	1.296
10	Before the operation my trainer discusses what part of the procedure, I will perform	3.13	1.103
11	My trainer expects my surgical skills to be as good as his/hers	3.23	1.203
12	My trainer gives me feedback on my performance	3.43	0.992
13	My trainer's criticism is constructive	3.64	1.017
14	On this unit the type of operations performed are too complex for my level	*3.48	1.089
15	The elective operating list has the right case mix to suit my training	4.03	0.875
16	There are far too many cases on the elective list to give me the opportunity to operate	3.28	1.035
17	I get enough opportunity to assist	4.26	0.705
18	There are enough theatre sessions per week for me to gain the appropriate experience	4.21	0.839
19	More senior trainees take my opportunities to operate	*2.82	1.148
20	The number of emergency procedures is sufficient for me to gain the right operative experience	4.11	0.985
21	The variety of emergency cases gives me the appropriate exposure	4.34	0.793
22	My trainer is in too much of a rush during emergency cases to let me operate	*3.39	1.201
23	I miss out on operative experience because of restrictions on working hours	*3.95	0.921
24	I have the opportunity to develop the skills required at my stage	4.03	0.632
25	The atmosphere in theatre is pleasant	4.03	0.983
26	In theatre I don't like being corrected in front of medical students, nurses and residents	*3.30	1.216
27	The nursing staff dislike it when I operate as the operation takes longer	*2.57	1.087
28	The anaesthetists put pressure on my trainer to operate himself to reduce anaesthetic time	*2.43	1.218
29	The theatre staff are friendly	3.82	0.719
30	I feel discriminated against in theatre because of my sex	*3.72	1.267
31	I feel discriminated against in theatre because of my race	*4.41	0.668
32	I feel part of a team in theatre	4.05	0.805

33	I am too busy doing other work to go to theatre	*3.80	0.963
34	I am often too tired to get the most out of theatre teaching	*3.48	1.149
35	I am so stressed in theatre that I do not learn as much as I could	*3.23	1.283
36	I am asked to perform operations alone that I do not feel competent at	*4.02	0.764
37	When I am in theatre, there is nobody to cover the ward	*4.00	1.183
38	I get bleeped during operations	*3.31	0.867
39	The level of supervision in theatre is adequate for my level	3.95	0.825
40	Theatre sessions are too long	*3.38	1.186

*: Reverse coded responses. *The responses were color coded. Green for most positive and favorable responses and red for less positive responses needing actions to improve their impression.*

Mean STEEM score for each subscale was further categorized

according to gender and is summarized in Table 3. No significant difference was observed in mean scores in any of the subscales as well as total mean score, based on gender. Mean STEEM score for each subscale was also categorized according to age and (no significant difference found) and is summarized in Table 4.

Table NO. 3: STEEM score according to gender

STEEM Subscales	Gender		P-value
	Male	Female	
Trainees' perceptions of their trainer and training	47.95 ± 7.76	49.06 ± 9.16	0.670
Trainees' perceptions of learning opportunities	42.51 ± 6.17	40.25 ± 4.44	0.126
Trainees' perceptions of the atmosphere in the operating theatre	28.60 ± 4.50	27.56 ± 3.16	0.324
Trainees' perceptions on Supervision, workload and Support	28.97 ± 4.98	29.68 ± 3.11	0.513
Total Score	148.03 ± 19.92	146.55 ± 14.61	0.755

A statistically significant difference ($p=0.029$) in mean response was found between groups based on year of residency. Table 5 describes comparison of mean scores based on year of residency in all subscales. Post-hoc analysis showed that students of year 1

and 5 have significantly more positive perception compared to year 2,3, and 4 residents. Overall 53 residents perceived learning environment as positive (>120 score) compared to only 8 who perceived it less satisfactorily (<120 score).

Table NO. 4: STEEM score according to age of participants

STEEM Subscales	Age		P-value
	≤ 30 years (n=45)	>30 years (n=16)	
Trainees' perceptions of their trainer and training	49.56 ± 6.87	46.95 ± 9.07	0.250
Trainees' perceptions of learning opportunities	42.16 ± 5.89	41.58 ± 6.19	0.727
Trainees' perceptions of the atmosphere in the operating theatre	27.76 ± 4.66	29.08 ± 3.45	0.239
Trainees' perceptions on Supervision, workload and Support	29.40 ± 4.13	29.12 ± 4.57	0.820
Total Score	148.90 ± 16.65	146.75 ± 20.59	0.681

Table NO. 5: STEEM score according to year of residency of participants

STEEM Subscales	Year of Residency					P-value
	1 st year (n=7)	2 nd year (n=9)	3 rd year (n=20)	4 th year (n=13)	5 th year (n=11)	
Trainees' perceptions of their trainer and training	52.71 ± 4.92	48.88 ± 5.55	45.95 ± 7.81	44.53 ± 10.64	53.63 ± 4.54	0.017
Trainees' perceptions of learning opportunities	44.28 ± 4.15	39.00 ± 1.65	41.28 ± 7.68	42.00 ± 5.97	43.90 ± 3.64	0.297
Trainees' perceptions of the atmosphere in the operating theatre	31.00 ± 6.42	25.88 ± 1.83	27.09 ± 4.48	29.15 ± 3.10	30.00 ± 2.96	0.035
Trainees' perceptions on Supervision, workload and Support	31.42 ± 2.07	26.33 ± 2.50	27.52 ± 5.67	30.76 ± 3.85	31.27 ± 3.13	0.013
Total Score	159.43 ± 14.68	140.01 ± 5.44	141.86 ± 21.11	146.46 ± 21.04	158.82 ± 11.68	0.029

Discussion: As medical education becomes more learner centered, approaches that shift responsibility for learning became more important. Residents' perception of their environment is a key factor of residency accreditation. It is a strong predictor of residents' satisfaction. A good learning corresponds positively with the trainee's perceptions of the environment, which in turn impacts trainee's learning experiences and outcomes (Cassar, 2004).

This study has helped us determining the perception of our residents regarding the educational environment. For this study, STEEM Questionnaire was used. After the development of STEEM questionnaire in 2004 by Cassar et al, many studies have been conducted by various authors to evaluate the perception of under and post graduate medical students (Cassar, 2004; Kieu et al., 2015). Almost all the investigators found that STEEM questionnaire is a reliable, dependable and practical tool for evaluating the operating theatre Educational Environment (EE) of postgraduate surgical trainees. In a previous study conducted in Pakistan (Soomro, Rehman, & Hussain, 2017). This questionnaire has already been validated. We also calculated reliability of this questionnaire by Cronbach alpha coefficient and found very high reliability (0.908). Reliability analysis for individual subscales were also average to high (0.602 to 0.871) indicating that the STEEM instrument is a highly reliable.

In the present study, males were 45 and 16 were female responders. Gender distribution was comparable with study of Cassar et al. which had 20 males and 6 females while it was equal male female numbers found in a study from Saudi Arabia 45 male and 46 female (Al-Qahtani & Al-Sheikh, 2012; Cassar, 2004). This may indicate that less female doctors are opting

for pediatric surgery residency compared to male doctors. But overall, in our experience, the trend of female doctors to opt for pediatric surgery is increasing every year.

We calculated mean STEEM score for each item (total 40 items) and found a maximum score of 4.46 (item no.6) and minimum score of 2.43 (item no. 28) with overall mean item score of 3.69 ±0.48. This reflects an overall positive perception for each item assessed. Soomro et al also calculated minimum and maximum mean scores and found 2.5 and 4.52, respectively, among all 40 items of STEEM (Soomro et al., 2017). In our study the STEEM mean total score was 147.66/200 which was comparable with previous reports in literature. Cassar et al found it 148.7/200 (Soomro et al., 2017). This is also indicative of overall positive perception of our residents regarding their learning environment in operation theatre. Contrarily, Al-Qahtani et al, found overall mean score of 110/200 (Al-Qahtani & Al-Sheikh, 2012). In another study from Pakistan conducted by Soomro et al. also found positive perception on STEEM mean score (136/200) (Soomro et al., 2017). Nagraj et al from United Kingdom also had the similar score in their study (139/200) (Nagraj, Wall, & Jones, 2006). The results of present study showed that STEEM subscale "trainer and training" mean score was 48.25/65 (74.23%). Previous studies also showed similar percentage score (65.00%-73.60%) for this subscale (Binsaleh, Babaeer, Rabah, & Madbouly, 2015; Kanashiro, McAleer, & Roff, 2006; Mahoney, Crowe, & Harris, 2010; Roff et al., 1997; Soomro et al., 2017). Similarly, mean scores of other subscales of our study were also scored in positive direction ("learning opportunities" 76.21%, "atmosphere in theatre" 70.82%, "supervision, workload, support" 72.9%). The spearman correlation coefficient also showed positive correlation between overall mean score and all

the subscales. This is quite satisfying for us that our residents are quite satisfied with the EE in operation theatre. In table 2, we have color coded the mean responses according to most positively scored and least positively scored items. The residents were most satisfied with trainer's enthusiasm, surgical skills. They were also satisfied with variety of cases and their volume, and no. of theatre sessions per week. Their concerns, as reflected in least mean scores, were related to the senior residents taking their opportunity to operate; scrub nurses; and anesthetists who pushed the main surgeons to operate himself or herself to avoid prolonging operation time. An important concern, that can be readily addressed, was about trainer not discussing surgical technique before operation. Based on the concerns identified on this evaluation a plan will be suggested to address their concern.

In this survey, STEEM score for each subscale was further categorized according to gender and found that it was not significantly different among females and males. Similarly, mean subscale score difference was also non-significant in report by Cassar et al; but Al-Qahtani et al found that there is a significant statistical gender difference as male scores more than females (Al-Qahtani & Al-Sheikh, 2012; Cassar, 2004). Similarly, we also categorized the data according to age of the participants and did not found any statistical difference in mean scores (overall and subscales). However, we have found statistically significant mean scores for overall and subscales except subscale 2 (learning opportunities). First year and final year residents scored more positively compared to residents of 2nd, 3rd, and 4th year. This finding can be extrapolated as the residents enter the residency program, they are enthusiastic and energetic and during subsequent years this enthusiasm may become less and while during the last year of their residency period they are about to appear in examination and become consultants after passing examination, so they may again become excited and understood the role of trainer, environment, and surgical work being given to them.

This study helped us evaluate our residents' perception about the learning environment and experience being provided to them especially in operation theatre. It encouraged us on many aspects and but also enlightened us about areas where improvement is necessary. This will improve our practice and learning.

This was a cross sectional study done in one hospital with not very high number of participants. The findings cannot be generalized to other centers in the country or globally where there are different practices regarding training of the residents. A multicentric study nationwide or with international collaboration will give us overall perception of the learning environment for surgical residents in operation theatre of various training sites. This will broaden our understanding about the problems faced

by the residents during their training period and similarly a wider range of solutions can be shared among various training sites across the globe.

Conclusion: Overall residents had good perception about their training and supervisors, learning opportunities in operation theatre, atmosphere in operation theatre, and supervision being provided to them. We are striving to address few of their concerns regarding briefing of the surgical technique before start of operation and operation lists are being adjusted to counter the length of operations in case of under-supervision surgeries for residents. Similarly, we have allocated residents appropriately to various operation rooms so that all the residents can have hands on supervised experience as per their level of training.

Declaration of interest: The authors report no conflict of interest.

Author's contribution:

- Nabila Talat: Conception and design of the work; & the acquisition, analysis, & interpretation of data for the work
- Ahsan Sethi: Critical Review and final approval of the version to be published

Reference:

- 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 medical journal*, 27(3), 217.
- Binsaleh, S., Babaeer, A., Rabah, D., & Madbouly, K. (2015). Evaluation of urology residents' perception of surgical theater educational environment. *Journal of surgical education*, 72(1), 73-79.
- Cassar, K. (2004). Development of an instrument to measure the surgical operating theatre learning environment as perceived by basic surgical trainees. *Medical teacher*, 26(3), 260-264.
- Hexter, A. T., O'Dowd-Booth, C., & Hunter, A. (2019). Factors that influence medical student learning in the operating room. *Medical teacher*, 41(5), 555-560.
- Kamine, T. H., Sabe, A. A., Nath, B., Barnes, K., & Kent, T. S. (2018). Use of learning teams to improve the educational environment of general surgery residency. *Journal of surgical education*, 75(6), e17-e22.

Kamran, R., Al-Eraky, M., Izhaar, F., & Anjum, K. M. (2018). EDUCATIONAL ENVIRONMENT. *The Professional Medical Journal*, 25(08), 1270-1276.

Kanashiro, J., McAleer, S., & Roff, S. (2006). Assessing the educational environment in the operating room—a measure of resident perception at one Canadian institution. *Surgery*, 139(2), 150-158.

Kieu, V., Stroud, L., Huang, P., Smith, M., Spychal, R., Hunter-Smith, D., & Nestel, D. (2015). The operating theatre as classroom: a qualitative study of learning and teaching surgical competencies. *Education for Health*, 28(1), 22.

Mahoney, A., Crowe, P. J., & Harris, P. (2010). Exploring Australasian Surgical Trainees' Satisfaction with Operating Theatre Learning Using the 'Surgical Theatre Educational Environment Measure'. *ANZ journal of surgery*, 80(12), 884-889.

Nagraj, S., Wall, D., & Jones, E. (2006). Can STEEM be used to measure the educational environment within the operating theatre for undergraduate medical students? *Medical teacher*, 28(7), 642-647.

Roff, S., McAleer, S., Harden, R. M., Al-Qahtani, M., Ahmed, A. U., Deza, H., . . . Primparyon, P. (1997). Development and validation of the Dundee ready education environment measure (DREEM). *Medical teacher*, 19(4), 295-299.

Sandhu, A., Liaqat, N., Waheed, K., Ejaz, S., Khanum, A., Butt, A., . . . Dar, S. H. (2018). Evaluation of educational environment for postgraduate residents using post graduate hospital educational environment measure. *J Pak Med Assoc*, 68(5), 790-792.

Soomro, S. H., Rehman, S. S. U., & Hussain, F. (2017). Perception of educational environment in the operating theatre by surgical residents, a single-centre prospective study. *JPMA*, 67(1864).