

Evaluation of the anaesthetic theatre educational environment at the University of the Witwatersrand

Saad Ali Khan

A research report submitted to the Faculty of Health Sciences, University of the Witwatersrand, Johannesburg in partial fulfilment of the requirements for the degree of Master of Medicine in the branch of Anaesthesiology.

Johannesburg, 2020

Declaration

I, Saad Ali Khan declare that this research report is my own unaided work. It is being submitted for the Degree of Master of Medicine in the branch of Anaesthesiology at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at any other University.

28 February 2020

Dedication

In the name of God, Most Gracious, Most Merciful. Unending praises and thanks are due to The Almighty. Greetings and salutations upon the noblest and most perfect of all creation, our Master Muhammad (PBUH), and his family.

To my grandad smiling down from heaven, who always prioritised and instilled in us all the importance of education from a young age.

Abstract

Background

The educational environment impacts on various aspects of students' professional development and well-being and is an important aspect of medical education programmes. Limited research investigating the theatre educational environment has been identified in South Africa and there is limited understanding of this environment at the University of the Witwatersrand (Wits). This study aims to describe the educational environment in theatre for registrars in the Department of Anaesthesiology at Wits.

Methods

A prospective, descriptive study design was followed, involving anaesthetic registrars at Wits, using the adapted Anaesthetic Theatre Educational Environment Measure (ATEEM) questionnaire between April and June 2019. A convenience sampling method was implemented to administer the anonymous questionnaire. Categorical variables were described using numbers and percentages. Descriptive statistics were used to calculate the total scores. The independent t-test or analysis of variance test was used to make comparisons.

Results

A total of 85 (78.7%) anaesthetic registrars participated in this study. The mean total (SD) adapted ATEEM score was 116.5 (16.9) out of a total of 164. The total score for male and female registrars was 118.4 (13.5) and 115.3 (18.7) respectively ($p=0.419$). First-year registrars scored 121.6 (14.3), second years 111.1 (19.0), third years 111.4 (14.6) and fourth years 122.3 (18.7) ($p=0.003$). Junior and senior registrars scored 117.1 (17.0) and 115.7 (17.1) respectively ($p=0.708$). The three hospitals were scored 112.3 (19.5), 119.8 (16.4) and 115.4 (12.0) respectively ($p=0.187$). The mean scores for the five domains were autonomy 25.4/32 (3.1), perception of atmosphere 31.6/44 (5.4), workload/supervision/support 17.3/28 (3.5), perception of teachers and teaching 14.3/20 (2.9), and learning opportunities and orientation to learning 27.9/40 (5.1). The autonomy domain was assessed as being excellent while all the other domains were assessed as more positive than negative, but with room for improvement.

Conclusion

The theatre educational environment is perceived as more positive than negative, but with room for improvement. All the domains, except autonomy, require attention to further improve the educational environment. With the availability of a validated instrument to assess the educational environment objectively and quantitatively, regular quality assessments of the educational environment should be included in the training institution's practice.

Acknowledgements

I wish to express my sincere gratitude to my research supervisors Juan, Helen and Lionel for their valuable time, patience, guidance and support.

This journey would not have been possible without the love and support of my amazing friends and each and every family member.

I am especially grateful to my parents and siblings for their unwavering love, support and encouragement throughout my life.

My wholehearted thanks to my wife, Noumeen, who has been extremely supportive and patient throughout this entire process.

To my colleagues who took the time to complete the questionnaire thereby making this study possible.

Table of contents

Declaration	ii
Dedication	iii
Abstract	iv
Acknowledgements	v
Table of contents	vi
Abbreviations.....	x
Statement	xi
Section 1 Review of the literature	1
1.1 Introduction	1
1.2 Postgraduate medical education	1
1.3 Educational environment.....	2
1.4 Measurement of the educational environment	5
1.4.1 ATEEM	6
1.4.2 Reliability and validity of the ATEEM	8
1.5 Educational environment of anaesthesiology registrars	9
1.6 Summary.....	11
1.7 References.....	12
Section 2 Author's guidelines BMC Medical Education	18
Section 3 Draft article	29
Section 4 Proposal	49

4.1 Introduction and problem statement.....	50
4.2 Aim and objectives	52
4.2.1 Aim.....	52
4.2.2 Objectives	52
4.3 Research assumptions.....	52
4.4 Demarcation of study field.....	53
4.5 Ethical considerations	53
4.6 Research methodology	54
4.6.1 Research design	54
4.6.2 Study population	55
4.6.3 Study sample	55
4.6.4 Data collection	56
4.6.5 Data analysis	57
4.7 Significance of the study	58
4.8 Validity and reliability of the study	59
4.9 Potential limitations	60
4.10 Project outline	60
4.10.1 Time frame.....	60
4.10.2 Budget	61
4.11 References.....	62
4.12 Appendices	67

Section 5 Annexures	75
5.1 Ethics approval.....	75
5.2 Graduate studies approval	76
5.3 Turnitin report.....	77

List of tables

Table 1 Characteristics of respondents 36

Table 2 Distribution of adapted ATEEM scores of respondents 36

Table 3 Score for each domain of the questionnaire 37

Table 4 Adapted ATEEM score comparison between characteristics 38

Table 5 Adapted ATEEM score for each domain at the different hospitals 39

Table 6 Scores for racial discrimination in the training post..... 39

Abbreviations

ACGME	Accreditation Council for Graduate Medical Education
AfriMEDS	African Medical Education Directives for Specialists
ATEEM	Anaesthetic Theatre Educational Environment Measure
CanMEDS	Canadian Medical Education Directives for Specialists
DREEM	Dundee Ready Education Environment Measure
PHEEM	Postgraduate Hospital Educational Environment Measure
STEEM	Surgical Theatre Educational Environment Measure
UK	United Kingdom
WFME	World Federation for Medical Education
Wits	University of the Witwatersrand

Statement

The Research Report consists of a literature review, draft article, study proposal and appendices. The study proposal is included for background reference and is not for examination.

The formatting of this Research Report complies with the University of the Witwatersrand's Style Guide for Theses, Dissertations and Research Reports. The formatting of the draft article may differ from the author guidelines of the BMC Medical Education, the journal to which it is intended to be submitted, in order to comply with the university's style guide.

Section 1 Review of the literature

1.1 Introduction

This section will discuss postgraduate medical education, the educational environment, the measurement of the educational environment, the Anaesthetic Theatre Educational Environment Measure (ATEEM) instrument, the reliability and validity of the ATEEM and the educational environment of anaesthesiology registrars.

1.2 Postgraduate medical education

Anaesthesiology is a branch of medicine concerned with the care of surgical patients before, during and after surgery as well as the management of pain (1). Training to become an anaesthesiologist is one of the many domains of postgraduate medical education that can be pursued. The World Federation for Medical Education (WFME) (2) defines postgraduate medical education as “the phase in which doctors develop competencies under supervision towards independent practice after completion of their basic medical qualification”. The objective of any postgraduate medical education programme is to produce specialists who can provide the highest quality of care to their patients (2).

An important development in medical training programmes since the year 2000 has been the move towards competency-based education, “the notion that an expert physician is defined by a broad set of identified competencies” (3). Many competency frameworks that outline these core competencies have been developed. Examples of these include the Accreditation Council for Graduate Medical Education (ACGME) in the United States of America (4), Canadian Medical Education Directives for Specialists (CanMEDS) (5), and Tomorrow’s Doctor in the United Kingdom (6). These frameworks have been adopted and adapted by countries all over the world (3).

The CanMEDS framework was developed by the Royal College of Physicians and Surgeons of Canada in the 1990s and was implemented in Canada in 1996. The framework has since undergone two revisions, with the most recent revision of the

framework in 2015. Since the inception of the framework, it has become widely accepted and widely utilised throughout the world. The CanMEDS educational framework identifies the core competencies required for medical education and practice. These identified competencies have been organised under seven major roles of a physician. These roles are that of a medical expert, communicator, collaborator, leader, health advocate, scholar and professional. The acquisition of these seven roles and their identified competencies are important to produce competent specialists that provide quality patient care (7).

In South Africa, the African Medical Education Directives for Specialists (AfriMEDS) framework (8) was developed in 2014 by the Undergraduate Education and Training Subcommittee of the Medical and Dental Professions board. The AfriMEDS model was adapted from the CanMEDS model and is utilised for undergraduate medical teaching and learning programmes in South Africa (8). The postgraduate training curriculum of the College of Anaesthetists of South Africa has adopted the CanMEDS model (9).

One of the most important factors determining the acquisition of the identified competencies by the different frameworks is the quality of the training programme. The WFME has established a set of international standards for postgraduate medical education for the purpose of quality assurance and the improvement of postgraduate medical education programmes to produce competent specialist physicians. These standards have been developed by focusing on broad categories that have been identified to play a pivotal role in the quality of postgraduate medical education and training. These categories are the content, process, structure, assessment, outcome and educational environment of postgraduate medical education and training (2).

1.3 Educational environment

According to the American Medical Association (10), the educational environment is “a social system that includes the learner (including the external relationships and other factors affecting the learner), the individuals with whom the learner interacts, the setting(s) and purpose(s) of the interaction, and the formal and informal rules/policies/norms governing the interaction”.

The education of specialists in anaesthesia is complex because trainees must learn to balance a myriad of tasks in addition to their constant learning and becoming competent at their specialities. Additional tasks that trainees have to deal with include financial stressors, responsibility of patient care, long working hours, heavy workload, patient deaths, teaching juniors, requirements of family and personal life, demands and expectations of senior staff (11) and the compulsory research component introduced by the Health Professions Council of South Africa since 2011 (12).

The process of learning depends on several factors, including the motivation of a student, perception of relevance, previous experience and learning style. All these factors are in turn influenced by the environment in which learning takes place, namely the educational environment. Adult learning theories have emphasised that teaching is as much about the environment in which learning takes place as it is about imparting knowledge (13).

The educational environment consists of three spheres:

- Physical sphere – safety (14-16), nutrition (14-16), comfort (14-16), facilities and atmosphere (17, 18);
- Emotional sphere – personal support (14, 15), teamwork (18), feeling welcomed and appreciated (18), absence of bullying and harassment (14-16); and
- Intellectual sphere – learning opportunities (18), quality of the educators (17), quality of the supervision (17, 18), reasonable academic demands (18).

The quality of all these spheres contributes to how students perceive the educational environment. Is the educational environment perceived as “authoritarian, over-competitive, stressful, intimidating to the point of being dysfunctional, or is it motivating?” (19) The way that the educational environment is perceived is important because an environment that is conducive to learning is considered to be a learning agent that stimulates the learning process (20) and the accomplishment of goals and objectives (21) necessary for quality postgraduate training (18, 22). In addition to affecting students’ academic achievements and

success (23, 24), the educational environment also impacts students' motivation (16, 25, 26), behaviour and attitude (26, 27), well-being and happiness (26), burnout rates (28), career satisfaction (23, 29), and studying and learning approaches (19, 30, 31).

Studies from the medical and educational literature that have illustrated the impact of the educational environment on the academic and psychological well-being of students will briefly be discussed.

A multicentre study was conducted in Japan (24) in 2013 to investigate the association between the hospital educational environment in 21 different Japanese teaching hospitals and the academic performance of 206 residents in the General Medicine In-Training examination. The study found a positive correlation between the academic performance of residents and the educational environment of their teaching hospital.

Burnout amongst health care professionals has gained attention and a study by Van der Walt et al. (32) in 2013 reported high levels of burnout (21%) amongst anaesthesiologists at the University of the Witwatersrand (Wits). Research conducted by Llera and Durante (28) in Argentina in 2011 found a significant correlation between the educational environment and burnout in residency programmes at a university hospital.

A study by Mahomed (33) in 2016 investigating the learning approaches of anaesthetists at Wits, found that anaesthetists tend to adopt deep, strategic and surface approaches to varying degrees. Ramsden and Entwistle (30) in 1981 were the first to describe a relationship between approaches to learning and the perception of the educational environment. A study by Lizzio et al. (31) in 2002 at an Australian university supported the findings of the first study by Ramsden and Entwistle (30). They illustrated that a good educational environment influences students to adopt deep approaches to studying whereas a poor educational environment influences students towards surface approaches.

From the literature, it is evident that the educational environment impacts on various aspects of students' professional development (23, 24) and well-being (26), and it is for this reason that the educational environment is receiving

increasing attention as an important aspect of medical education programmes (2, 23, 26).

1.4 Measurement of the educational environment

Over the past few years, the WFME has shown a great deal of interest in the quality assessment and improvement of education programmes. The evaluation of medical education programmes is important as evaluation is the driving force of the change process (34). However, monitoring the quality of education programmes can be a challenge. The WFME has identified the assessment of the educational environment as one of the methods for assessing and ensuring the quality of medical education programmes (23, 26).

The link between the educational environment and the quality of the education programme illustrates the need for training institutions to become more accountable for ensuring the necessary supportive educational environment for their trainees by regularly performing quality assessments of the educational environment (21). By conducting these quality assessments of the educational environment, factors that encourage or inhibit development can be identified, prioritised for improvement and measured on an ongoing basis to assist with curriculum development and changes (21).

Accurate quantitative assessments of the educational environment remain challenging (35). Many instruments have been developed over the years to help with assessments of the educational environment of teaching programmes, but only a few instruments specifically assess the quality of the unique educational environment in the hospital setting (36). These instruments include the Dundee Ready Education Environment Measure (DREEM) (37), the Postgraduate Hospital Educational Environment Measure (PHEEM) (38), the Surgical Theatre Educational Environment Measure (STEEM) (39) and the Anaesthetic Theatre Educational Environment Measure (ATEEM) (19).

The 50-item DREEM questionnaire was the first of the abovementioned instruments to be developed, with the focus on the assessment of undergraduate students in health professional education. It was developed by Roff et al. (37) in 1997 using grounded theory and an international Delphi panel of close to 100

health professions educators. It has been used worldwide and is widely validated and found to be reliable (40).

PHEEM was developed by Roff et al. (38) in 2005 in the United Kingdom, through grounded theory involving focus groups and Delphi methods, to assess the postgraduate educational environment in the hospital setting (38, 41). The PHEEM questionnaire is multidimensional and focuses on three dimensions that are important in the training of hospital-based doctors (41). These dimensions are autonomy, teaching and social support. The questionnaire contains 40 items relevant to the educational environment (38). The PHEEM instrument has been validated extensively and has a very high internal reliability (36, 41).

The DREEM and PHEEM instruments are useful in assessing the educational environment in the postgraduate hospital setting, but these instruments are not specifically developed for certain disciplines (36). The educational environment in each clinical discipline is unique (42) and this supports the need for instruments to be developed for the assessment of the educational environment in a specific setting. STEEM and ATEEM are developed for specific settings (36).

The STEEM instrument is developed for assessing the educational environment for surgical trainees in the operating room. As this instrument is specifically for surgical trainees, it will not be discussed further (36).

1.4.1 ATEEM

The ATEEM instrument was developed by Holt and Roff (19) in 2004 in the United Kingdom (UK). The ATEEM is a specific instrument for the objective measurement of the anaesthetic theatre educational environment (19).

The ATEEM was developed using a similar methodology to that which was utilised in the development of the DREEM and PHEEM. Multiple phases and participants were involved in the development process. The inclusion of a broad base of participants, including anaesthetic educational supervisors, anaesthetic trainees and anaesthetic programme directors, ensured that the developed inventory was generated with sufficient insight into the field of anaesthesia and directly from the context in which it was to be used (19).

The first phase in the development of the ATEEM comprised a search of the literature to ascertain attributes essential for “good clinical teaching and anaesthesia training” in the theatre environment. From this search, a preliminary inventory of items was developed to measure the theatre educational environment. Further items were then added to this initial inventory by using three focus groups, which consisted of 14 anaesthetic trainees, 32 educational supervisors and 3 programme directors. This inventory was then distributed to 32 educational supervisors and 3 programme directors from different schools involved in anaesthetic training in the English Midlands region for further input. A total of 156 items formed part of the initial inventory that was developed (19).

The following phase then commenced to refine, validate and improve the reliability of the instrument. The 156-item inventory was distributed to trainee anaesthetists at a teaching facility in the UK. The trainees were asked to rate each item in the inventory using a Likert scale to assess how important they felt each item in the inventory was in creating a good theatre educational environment. The 43 items that were rated highest by the trainees were then chosen (19).

A qualitative analysis was then performed on these 43 items by anaesthetic educational supervisors. After this analysis, the number of items was refined to 40 by eliminating items that were deemed to be repetitive. A qualitative analysis and statistical factor analysis was then performed on the 40 items to arrange them into different domains (19).

The final ATEEM questionnaire that was developed by Holt and Roff (19) consists of 40 items covering a range of issues affecting the educational environment in theatre. These 40 items are clustered into five domains, namely autonomy, perception of atmosphere, workload/supervision/support, perception of teachers and teaching, and learning opportunities and orientation to learning. Autonomy is represented by 8 items, perception of atmosphere by 10 items, workload, supervision and support by 7 items, perception of teachers and teaching by 5 items, and learning opportunities and orientation to learning by 10 items (19).

Each of the 40 items was rated from 0 – 4. Respondents indicated their agreement with each of the items according to a 5-point Likert scale. Respondents indicated

whether they strongly agree (4), agree (3), are unsure (2), disagree (1) or strongly disagree (0) with each of the items. Two of the 40 items were negative statements and reversed scoring applied to these items. A maximum score of 160 was possible for the questionnaire (19).

The total score obtained for the questionnaire and each domain indicates the quality of the educational environment in theatre and which of the five domains are problematic and require intervention. The overall score can be interpreted according to the following guide:

- 0 – 41 Very poor educational environment
- 42 – 82 Plenty of problems with the educational environment
- 83 – 123 More positive than negative, but there is room for improvement
- 124 – 164 Excellent educational environment (38).

1.4.2 Reliability and validity of the ATEEM

The consistency and accuracy, known as reliability and validity, are important factors that need to be considered when utilising research tools to gather data. The researcher needs to be aware of whether the results obtained are consistent and repeatable (is it reliable?) and if the research tool being used actually measures what it was designed to measure (is it valid?) (36).

One of the common methods used to assess the internal reliability of a questionnaire is the Cronbach's alpha coefficient. A Cronbach's alpha of at least 0.7 is considered acceptable for questionnaires (43). In the first study (34) where the ATEEM instrument was developed and used, a Cronbach's alpha calculation was not included. However, two other studies using the ATEEM were identified. In these studies conducted in 2014 in Iran (44) and in 2016 in Pakistan (13), the Cronbach's alpha was calculated as 0.96 and 0.81, indicating acceptable internal reliability of the ATEEM.

The Iranian study (44) translated the original ATEEM questionnaire into Persian and subsequently evaluated the validity of the Persian version by assessing the face validity, content validity and construct validity. The study found that the

questionnaire had good validity and that the psychometrics of the ATEEM instrument were suitable to measure the theatre educational environment.

The majority of instruments used to measure the educational environment are not based on any theoretical framework (45). From the development process of the ATEEM instrument, it is evidently not based on any theoretical framework. Having such a framework might help in ensuring that all the essential concepts are measured to accurately determine the quality of the educational environment (45). These frameworks also allow a reflection of the multiple relationships within the educational environment, such as teachers and students.

Students and teachers do not always perceive the educational environment in a similar manner (46). The teacher's perception of the educational environment can affect teacher attitudes, behaviours and performance (47). The ATEEM is unidimensional as it assesses only the students' perception of the educational environment. The students' and teachers' perceptions need to be considered when optimising the educational environment.

1.5 Educational environment of anaesthesiology registrars

Three international studies that used the ATEEM instrument were identified in the literature. One study was conducted in a developed country, namely the UK (19). Two studies were conducted in developing countries, namely Iran (44) and Pakistan (15).

The UK study (19) was conducted in 2004 and included 218 trainee anaesthetists. The study found a mean total ATEEM score of 117/160. This score indicated an educational environment that was perceived by trainees as more positive than negative, but with room for improvement. The lowest scoring domain was learning opportunities and orientation to learning, while the perception of atmosphere domain was the highest scoring. There was a statistically significant difference observed between the different years of training, with the second and fifth registrar years scoring the lowest and the third registrar year scoring the highest. No reasons were provided for the differences observed between the different years of training.

The Iranian study (44) was conducted in 2004 and included 156 anaesthesiology residents. The mean total ATEEM score was 114/160, indicating an educational environment that was perceived as more positive than negative, but with room for improvement. The autonomy domain was the highest scoring, while the workload, supervision and support domain was the lowest scoring. There was no statistically significant difference in the total scores between the different years of training. There was also no statistically significant difference observed between male and female respondents.

The Pakistani study (15) was conducted in 2016 and included 60 anaesthetic trainees. The study was conducted amongst trainees in the anaesthesia departments of a public (30 trainees) and private hospital (30 trainees). In addition to assessing the learning environment for anaesthesia trainees, the scores between the public and private sectors were compared. The mean total ATEEM score in the public hospital was 109/160; trainees experienced the environment in the public sector more positively than negatively, but with room for improvement. Autonomy was the highest scoring domain in the public sector. The lowest scoring domain in the public sector was workload, supervision and support. The private sector educational environment was perceived as excellent by the trainees, with a mean total ATEEM score of 129/160. There was a statistically significant difference in the perception of the educational environment between the public and private sectors. There was no statistically significant difference observed based on the sex of respondents.

No studies evaluating the theatre educational environment quantitatively for anaesthetic registrars in South Africa could be identified.

A qualitative study by Cuthbert (48) in 2017 analysing registrars' experience of their training at the Wits Department of Anaesthesiology was identified. From the narratives, it was found that, overall, the Wits Department of Anaesthesiology was a positive place in which to learn, but some anaesthesiology registrars experienced their environment as suboptimal and described it as stressful, exhausting and competitive. There were no specific changes made to the training programme subsequent to this study.

1.6 Summary

Anaesthesiology registrars spend most of their time in theatre and this is the educational environment in which most of their training occurs. Students do not always experience the educational environment in a way that it is intended or experienced by the designers (46). The literature has illustrated that the educational environment is a major contributor to the quality of postgraduate medical education programmes and has been receiving increasing attention over the years. The quality of the theatre educational environment for anaesthesiology registrars at Wits is yet to be explored quantitatively. However, in light of the fact that a supportive learning environment is pertinent to the professional and moral development of anaesthetic trainees, this educational environment needs to be assessed to ultimately ensure a quality postgraduate medical education programme that produces competent specialists that provide the safest and highest quality of care to patients.

1.7 References

1. American Society of Anesthesiologists. What is anesthesiology? [Internet]. Washington DC, USA: American Society of Anesthesiologists [Accessed: 30/06/2018]. Available from: <http://www.asahq.org/lifeline/types%20of%20anesthesia/what%20is%20anesthesiology>.
2. World Federation for Medical Education. Postgraduate medical education. WFME global standards for quality improvement [Internet]. Copenhagen, Denmark: World Federation for Medical Education; 2015 [Accessed: 30/08/2018]. Available from: <http://wfme.org/publications/wfme-global-standards-for-quality-improvement-pgme-2015/?wpdmdl=884';return>.
3. Norman G, Norcini J, Bordage G. Competency-based education: Milestones or millstones? J Grad Med Educ. 2014;6(1):1-6. doi:10.4300/JGME-D-13-00445.1.
4. Batalden P, Leach D, Swing S, Dreyfus H, Dreyfus S. General competencies and accreditation in graduate medical education. Health Aff. 2002;21(5):103-11. doi:10.1377/hlthaff.21.5.103.
5. The Royal College of Physicians and Surgeons of Canada. CanMEDS [Internet]. Ottawa, Canada: The Royal College of Physicians and Surgeons of Canada [Accessed: 30/08/2018]. Available from: <http://canmeds.royalcollege.ca/en/about/history>.
6. Rubin P, Franchi-Christopher D. New edition of Tomorrow's Doctors. Med Teach. 2002;24(4):368-9. doi:10.1080/0142159021000000816.
7. Frank JR, Snell L, Sherbino J. CanMEDS 2015 physician competency framework [Internet]. Ottawa, Canada: Royal College of Physicians and Surgeons of Canada; 2015 [Accessed: 30/08/2018]. Available from: <http://www.royalcollege.ca/rcsite/documents/canmeds/canmeds-full-framework-e.pdf>.

8. Undergraduate Education and Training Subcommittee of the Medical and Dental Professions Board. Core competencies for undergraduate students in clinical associate, dentistry and medical teaching and learning programmes in South Africa [Internet]. Pretoria, South Africa: Health Professions Council of South Africa; 2014 [Accessed: 30/07/2018]. Available from: http://www.hpcsa.co.za/uploads/editor/UserFiles/downloads/medical_dental/MDB%20Core%20Competencies%20-%20ENGLISH%20-%20FINAL%202014.pdf.
9. College of Anaesthetists of South Africa. Curriculum for trainees in anaesthesiology 2014 [Internet]. Johannesburg, South Africa: The Colleges of Medicine of South Africa; 2014 [Accessed: 30/07/2018]. Available from: https://www.cmsa.co.za/view_exam.aspx?QualificationID=1.
10. American Medical Association. Initiative to transform medical education, phase 3: Program implementation. Strategies for transforming the medical education learning environment [Internet]. Chicago, USA: American Medical Association; 2007 [Accessed: 01/09/2018]. Available from: http://med2.uc.edu/Libraries/Medical_Education_Documents/AMA_ITME_Project.sflb.ashx.
11. Daugherty SR, Baldwin DC Jr, Rowley BD. Learning, satisfaction, and mistreatment during medical internship: A national survey of working conditions. JAMA. 1998;279(15):1194-9. doi:10.1001/jama.279.15.1194.
12. Szabo C, Ramlall S. Research competency and specialist registration: Quo vadis? SAMJ. 2016;106(12):1183-5. doi:10.7196/SAMJ.2016.v106i12.11217.
13. Hutchinson L. ABC of learning and teaching: Educational environment. BMJ. 2003;326(7393):810. doi:10.1136/bmj.326.7393.810.
14. Khan MN. Evaluation of the learning environment of teaching hospitals of twin cities in Pakistan [Research report]: Stellenbosch University, Stellenbosch; 2014.
15. Zeb H, Rehman A, Niazi A. Assessment of learning environment in anesthesia by using ATEEM tool. Anaesth Pain Intensive Care. 2017;21(3):354-9. doi:1080/01421590120063312.

16. Idon P, Suleiman I, Olasoji O, Mustapha Z, Abba H. Postgraduate trainees' perceptions of the learning environment in a Nigerian teaching hospital. *Afr J Health Prof Educ.* 2017;9(3):116-22. doi:10.7196/AJHPE.2017.v9i3.786.
17. Boor K, Scheele F, Van Der Vleuten CP, Scherpbier AJ, Teunissen PW, Sijtsma K. Psychometric properties of an instrument to measure the clinical learning environment. *Med Educ.* 2007;41(1):92-9. doi:10.1111/j.1365-2929.2006.02651.x.
18. Kendall ML, Hesketh EA, Macpherson SG. The learning environment for junior doctor training: What hinders, what helps. *Med Teach.* 2005;27(7):619-24. doi:10.1080/01421590500069710.
19. Holt MC, Roff S. Development and validation of the Anaesthetic Theatre Educational Environment Measure (ATEEM). *Med Teach.* 2004;26(6):553-8. doi:10.1080/01421590410001711599.
20. Tomietto M, Comparcini D, Saarikoski M, Simonetti V, Cicolini G. Multilevel perspectives in clinical learning environments' assessment: An insight on levels involved in planning nursing education. *J Nurs Educ Pract.* 2014;4(12):42-50. doi:10.5430/jnep.v4n12p42.
21. Hoff TJ, Pohl H, Bartfield J. Creating a learning environment to produce competent residents: The roles of culture and context. *Acad Med.* 2004;79(6):532-40. doi:10.1097/00001888-200406000-00007.
22. Roff S, McAleer S. What is educational climate? *Med Teach.* 2001;23(4):333-4. doi:10.1080/01421590120063312.
23. Genn JM. AMEE Medical Education Guide No. 23 (Part 1): Curriculum, environment, climate, quality and change in medical education: A unifying perspective. *Med Teach.* 2001;23(4):337-44. doi:10.1080/01421590120063330.
24. Shimizu T, Tsugawa Y, Tanoue Y, Konishi R, Nishizaki Y, Kishimoto M, et al. The hospital educational environment and performance of residents in the General Medicine In-Training Examination: A multicenter study in Japan. *Int J Gen Med.* 2013;6:637-40. doi:10.2147/IJGM.S45336.

25. Tefera YA, Yirtaw TG, Mamo DB. Evaluation of the learning environment for residency training in Saint Paul's Hospital Millennium Medical College. *Ethiop Med J*. 2017;56(1):11-6. doi:10.1111/j.1365-2929.2006.02499.
26. Bakhshialiabad H, Bakhshi M, Hassanshahi G. Students' perceptions of the academic learning environment in seven medical sciences courses based on DREEM. *Adv Med Educ Pract*. 2015;6:195-203. doi:10.2147/AMEP.S60570.
27. Al-Marshad S, Alotaibi G. Evaluation of clinical educational environment at King Fahad Hospital of Dammam University using the Postgraduate Hospital Education Environment Measure (PHEEM) inventory. *Education in Medicine Journal*. 2011;3(2):6-14. doi:10.5959/eimj.3.2.2011.or1.
28. Llera J, Durante E. Correlation between the educational environment and burn-out syndrome in residency programs at a university hospital. *Arch Argent Pediatr*. 2014;112(1):6-11. doi:10.1590/S0325-00752014000100003.
29. Cross V, Hicks C, Parle J, Field S. Perceptions of the learning environment in higher specialist training of doctors: Implications for recruitment and retention. *Med Educ*. 2006;40(2):121-8. doi:10.1111/j.1365-2929.2005.02382.x.
30. Ramsden P, Entwistle NJ. Effects of academic departments on students' approaches to studying. *Br J Educ Psychol*. 1981;51(3):368-83. doi:10.1111/j.2044-8279.1981.tb02493.x.
31. Lizzio A, Wilson K, Simons R. University students' perceptions of the learning environment and academic outcomes: Implications for theory and practice. *Stud High Educ*. 2002;27(1):27-52. doi:10.1080/03075070120099359.
32. Van der Walt N, Scribante J, Perrie H. Burnout among anaesthetists in South Africa. *SAJAA*. 2015;21(6):169-72. doi:10.1080/22201181.2015.1102798.
33. Mahomed S. The learning styles and study behaviours of anaesthetists in a postgraduate training programme [Research report]: University of the Witwatersrand, Johannesburg; 2017.

34. Genn JM. AMEE Medical Education Guide no. 23 (part 2): Curriculum, environment, climate, quality and change in medical education: A unifying perspective. *Med Teach*. 2001;23(5):445-54. doi:10.1080/01421590120075661.
35. Colbert-Getz JM, Kim S, Goode VH, Shochet RB, Wright SM. Assessing medical students' and residents' perceptions of the learning environment: Exploring validity evidence for the interpretation of scores from existing tools. *Acad Med*. 2014;89(12):1687-93. doi:10.1097/ACM.0000000000000433.
36. Soemantri D, Herrera C, Riquelme A. Measuring the educational environment in health professions studies: A systematic review. *Med Teach*. 2010;32(12):947-52. doi:10.3109/01421591003686229.
37. Roff S, McAleer S, Harden RM, Al-Qahtani M, Ahmed AU, Deza H, et al. Development and validation of the Dundee ready education environment measure (DREEM). *Med Teach*. 1997;19(4):295-9. doi:10.3109/01421599709034208.
38. Roff S, McAleer S, Skinner A. 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*. 2005;27(4):326-31. doi:10.1080/01421590500150874.
39. Cassar K. Development of an instrument to measure the surgical operating theatre learning environment as perceived by basic surgical trainees. *Med Teach*. 2004;26(3):260-4. doi:10.1080/0142159042000191975.
40. Roff S. The Dundee Ready Educational Environment Measure (DREEM)- A generic instrument for measuring students' perceptions of undergraduate health professions curricula. *Med Teach*. 2005;27(4):322-5. doi:10.1080/01421590500151054.
41. Chan CY, Sum MY, Lim WS, Chew NW, Samarasekera DD, Sim K. Adoption and correlates of Postgraduate Hospital Educational Environment Measure (PHEEM) in the evaluation of learning environments- A systematic review. *Med Teach*. 2016;38(12):1248-55. doi:10.1080/0142159X.2016.1210108.

42. Patel VL, Dauphinee W. The clinical learning environments in medicine, paediatrics and surgery clerkships. *Med Educ.* 1985;19(1):54-60. doi:10.1111/j.1365-2923.1985.tb01139.x.
43. George D, Mallery P. *SPSS for Windows step by step: Answers to selected exercises.* 4th ed. Boston, USA: Allyn and Bacon; 2003.
44. Koohpayehzadeh J, Mirzaei Z, Zahedi H, Alebouyeh MR, Naghizadeh Moogari Z. Psychometric properties of the Persian version of the Anesthetic Trainee Theatre Educational Environment Measure (ATEEM). *Med J Islam Repub Iran.* 2019;33:13. doi:10.34171/mjiri.33.13.
45. Schönrock-Adema J, Bouwkamp-Timmer T, van Hell EA, Cohen-Schotanus J. Key elements in assessing the educational environment: Where is the theory? *Adv in Health Sci Educ.* 2012;17(5):727-42. doi:10.1007/s10459-011-9346-8.
46. Könings KD, Brand-Gruwel S, Van Merriënboer JJ. Towards more powerful learning environments through combining the perspectives of designers, teachers, and students. *Br J Educ Psychol.* 2005;75(4):645-60. doi:10.1348/000709905X43616.
47. Uline CL, Earthman GI, Lemasters LK. Teacher attitudes about classroom conditions. *J Educ Admin.* 2009;47(3):323-35. doi:10.1108/09578230910955764.
48. Cuthbert S. Anaesthesiology registrars' experience of their training at the University of the Witwatersrand: A Qualitative study [Research report]: University of the Witwatersrand, Johannesburg; 2017.

Section 2 Author's guidelines BMC Medical Education

Preparing your manuscript

The information below details the section headings that you should include in your manuscript and what information should be within each section.

Please note that your manuscript must include a 'Declarations' section including all of the subheadings (please see below for more information).

Title page

The title page should:

- present a title that includes, if appropriate, the study design e.g.:
 - "A versus B in the treatment of C: a randomized controlled trial", "X is a risk factor for Y: a case control study", "What is the impact of factor X on subject Y: A systematic review"
 - or for non-clinical or non-research studies a description of what the article reports
- list the full names and institutional addresses for all authors
 - if a collaboration group should be listed as an author, please list the Group name as an author. If you would like the names of the individual members of the Group to be searchable through their individual PubMed records, please include this information in the "Acknowledgements" section in accordance with the instructions below
- indicate the corresponding author

Abstract

The Abstract should not exceed 350 words. Please minimize the use of abbreviations and do not cite references in the abstract. Reports of randomized

controlled trials should follow the [CONSORT](#) extension for abstracts. The abstract must include the following separate sections:

- **Background:** the context and purpose of the study
- **Methods:** how the study was performed and statistical tests used
- **Results:** the main findings
- **Conclusions:** brief summary and potential implications
- **Trial registration:** If your article reports the results of a health care intervention on human participants, it must be registered in an appropriate registry and the registration number and date of registration should be included in this section. If it was not registered prospectively (before enrollment of the first participant), you should include the words 'retrospectively registered'. See our [editorial policies](#) for more information on trial registration

Keywords

Three to ten keywords representing the main content of the article.

Background

The Background section should explain the background to the study, its aims, a summary of the existing literature and why this study was necessary or its contribution to the field.

Methods

The methods section should include:

- the aim, design and setting of the study
- the characteristics of participants or description of materials
- a clear description of all processes, interventions and comparisons. Generic drug names should generally be used. When proprietary brands are used in research, include the brand names in parentheses

- the type of statistical analysis used, including a power calculation if appropriate

Results

This should include the findings of the study including, if appropriate, results of statistical analysis which must be included either in the text or as tables and figures.

Discussion

This section should discuss the implications of the findings in context of existing research and highlight limitations of the study.

Conclusions

This should state clearly the main conclusions and provide an explanation of the importance and relevance of the study reported.

List of abbreviations

If abbreviations are used in the text they should be defined in the text at first use, and a list of abbreviations should be provided.

Declarations

All manuscripts must contain the following sections under the heading 'Declarations':

- Ethics approval and consent to participate
- Consent for publication
- Availability of data and materials
- Competing interests
- Funding
- Authors' contributions

- Acknowledgements
- Authors' information (optional)

Please see below for details on the information to be included in these sections.

If any of the sections are not relevant to your manuscript, please include the heading and write 'Not applicable' for that section.

Ethics approval and consent to participate

Manuscripts reporting studies involving human participants, human data or human tissue must:

- include a statement on ethics approval and consent (even where the need for approval was waived)
- include the name of the ethics committee that approved the study and the committee's reference number if appropriate

Studies involving animals must include a statement on ethics approval and for experimental studies involving client-owned animals, authors must also include a statement on informed consent from the client or owner.

See our [editorial policies](#) for more information.

If your manuscript does not report on or involve the use of any animal or human data or tissue, please state "Not applicable" in this section.

Consent for publication

If your manuscript contains any individual person's data in any form (including any individual details, images or videos), consent for publication must be obtained from that person, or in the case of children, their parent or legal guardian. All presentations of case reports must have consent for publication.

You can use your institutional consent form or our [consent form](#) if you prefer. You should not send the form to us on submission, but we may request to see a copy at any stage (including after publication).

See our [editorial policies](#) for more information on consent for publication.

If your manuscript does not contain data from any individual person, please state “Not applicable” in this section.

Availability of data and materials

All manuscripts must include an ‘Availability of data and materials’ statement. Data availability statements should include information on where data supporting the results reported in the article can be found including, where applicable, hyperlinks to publicly archived datasets analysed or generated during the study. By data we mean the minimal dataset that would be necessary to interpret, replicate and build upon the findings reported in the article. We recognise it is not always possible to share research data publicly, for instance when individual privacy could be compromised, and in such instances data availability should still be stated in the manuscript along with any conditions for access.

Data availability statements can take one of the following forms (or a combination of more than one if required for multiple datasets):

- The datasets generated and/or analysed during the current study are available in the [NAME] repository, [PERSISTENT WEB LINK TO DATASETS]
- The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.
- All data generated or analysed during this study are included in this published article [and its supplementary information files].
- The datasets generated and/or analysed during the current study are not publicly available due [REASON WHY DATA ARE NOT PUBLIC] but are available from the corresponding author on reasonable request.
- Data sharing is not applicable to this article as no datasets were generated or analysed during the current study.

- The data that support the findings of this study are available from [third party name] but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. Data are however available from the authors upon reasonable request and with permission of [third party name].
- Not applicable. If your manuscript does not contain any data, please state 'Not applicable' in this section.

More examples of template data availability statements, which include examples of openly available and restricted access datasets, are available [here](#).

BioMed Central also requires that authors cite any publicly available data on which the conclusions of the paper rely in the manuscript. Data citations should include a persistent identifier (such as a DOI) and should ideally be included in the reference list. Citations of datasets, when they appear in the reference list, should include the minimum information recommended by DataCite and follow journal style. Dataset identifiers including DOIs should be expressed as full URLs. For example:

Hao Z, AghaKouchak A, Nakhjiri N, Farahmand A. Global integrated drought monitoring and prediction system (GIDMaPS) data sets. figshare. 2014. <http://dx.doi.org/10.6084/m9.figshare.853801>

With the corresponding text in the Availability of data and materials statement:

The datasets generated during and/or analysed during the current study are available in the [NAME] repository, [PERSISTENT WEB LINK TO DATASETS].^[Reference number]

If you wish to co-submit a data note describing your data to be published in [BMC Research Notes](#), you can do so by visiting our [submission portal](#). Data notes support [open data](#) and help authors to comply with funder policies on data sharing. Co-published data notes will be linked to the research article the data support ([example](#)).

For more information please email our [Research Data Team](#).

Competing interests

All financial and non-financial competing interests must be declared in this section.

See our [editorial policies](#) for a full explanation of competing interests. If you are unsure whether you or any of your co-authors have a competing interest please contact the editorial office.

Please use the authors initials to refer to each authors' competing interests in this section.

If you do not have any competing interests, please state "The authors declare that they have no competing interests" in this section.

Funding

All sources of funding for the research reported should be declared. The role of the funding body in the design of the study and collection, analysis, and interpretation of data and in writing the manuscript should be declared.

Authors' contributions

The individual contributions of authors to the manuscript should be specified in this section. Guidance and criteria for authorship can be found in our [editorial policies](#).

Please use initials to refer to each author's contribution in this section, for example: "FC analyzed and interpreted the patient data regarding the hematological disease and the transplant. RH performed the histological examination of the kidney, and was a major contributor in writing the manuscript. All authors read and approved the final manuscript."

Acknowledgements

Please acknowledge anyone who contributed towards the article who does not meet the criteria for authorship including anyone who provided professional writing services or materials.

Authors should obtain permission to acknowledge from all those mentioned in the Acknowledgements section.

See our [editorial policies](#) for a full explanation of acknowledgements and authorship criteria.

If you do not have anyone to acknowledge, please write "Not applicable" in this section.

Group authorship (for manuscripts involving a collaboration group): if you would like the names of the individual members of a collaboration Group to be searchable through their individual PubMed records, please ensure that the title of the collaboration Group is included on the title page and in the submission system and also include collaborating author names as the last paragraph of the "Acknowledgements" section. Please add authors in the format First Name, Middle initial(s) (optional), Last Name. You can add institution or country information for each author if you wish, but this should be consistent across all authors.

Please note that individual names may not be present in the PubMed record at the time a published article is initially included in PubMed as it takes PubMed additional time to code this information.

Authors' information

This section is optional.

You may choose to use this section to include any relevant information about the author(s) that may aid the reader's interpretation of the article, and understand the standpoint of the author(s). This may include details about the authors' qualifications, current positions they hold at institutions or societies, or any other relevant background information. Please refer to authors using their initials. Note this section should not be used to describe any competing interests.

Footnotes

Footnotes can be used to give additional information, which may include the citation of a reference included in the reference list. They should not consist solely of a reference citation, and they should never include the bibliographic details of a reference. They should also not contain any figures or tables.

Footnotes to the text are numbered consecutively; those to tables should be indicated by superscript lower-case letters (or asterisks for significance values and other statistical data). Footnotes to the title or the authors of the article are not given reference symbols.

Always use footnotes instead of endnotes.

References

Examples of the Vancouver reference style are shown below.

See our [editorial policies](#) for author guidance on good citation practice

Web links and URLs: All web links and URLs, including links to the authors' own websites, should be given a reference number and included in the reference list rather than within the text of the manuscript. They should be provided in full, including both the title of the site and the URL, as well as the date the site was accessed, in the following format: The Mouse Tumor Biology Database. <http://tumor.informatics.jax.org/mtbwi/index.do>. Accessed 20 May 2013. If an author or group of authors can clearly be associated with a web link, such as for weblogs, then they should be included in the reference.

Example reference style:

Article within a journal

Smith JJ. The world of science. Am J Sci. 1999;36:234-5.

Article within a journal (no page numbers)

Rohrmann S, Overvad K, Bueno-de-Mesquita HB, Jakobsen MU, Egeberg R, Tjønneland A, et al. Meat consumption and mortality - results from the European Prospective Investigation into Cancer and Nutrition. BMC Medicine. 2013;11:63.

Article within a journal by DOI

Slifka MK, Whitton JL. Clinical implications of dysregulated cytokine production. Dig J Mol Med. 2000; doi:10.1007/s801090000086.

Article within a journal supplement

Frumin AM, Nussbaum J, Esposito M. Functional asplenia: demonstration of splenic activity by bone marrow scan. *Blood* 1979;59 Suppl 1:26-32.

Book chapter, or an article within a book

Wyllie AH, Kerr JFR, Currie AR. Cell death: the significance of apoptosis. In: Bourne GH, Danielli JF, Jeon KW, editors. *International review of cytology*. London: Academic; 1980. p. 251-306.

OnlineFirst chapter in a series (without a volume designation but with a DOI)

Saito Y, Hyuga H. Rate equation approaches to amplification of enantiomeric excess and chiral symmetry breaking. *Top Curr Chem*. 2007.
doi:10.1007/128_2006_108.

Complete book, authored

Blenkinsopp A, Paxton P. Symptoms in the pharmacy: a guide to the management of common illness. 3rd ed. Oxford: Blackwell Science; 1998.

Online document

Doe J. Title of subordinate document. In: *The dictionary of substances and their effects*. Royal Society of Chemistry. 1999. [http://www.rsc.org/dose/title of subordinate document](http://www.rsc.org/dose/title%20of%20subordinate%20document). Accessed 15 Jan 1999.

Online database

Healthwise Knowledgebase. *US Pharmacopeia*, Rockville. 1998.
<http://www.healthwise.org>. Accessed 21 Sept 1998.

Supplementary material/private homepage

Doe J. Title of supplementary material. 2000. <http://www.privatehomepage.com>. Accessed 22 Feb 2000.

University site

Doe, J: Title of preprint. <http://www.uni-heidelberg.de/mydata.html> (1999).
Accessed 25 Dec 1999.

FTP site

Doe, J: Trivial HTTP, RFC2169. <ftp://ftp.isi.edu/in-notes/rfc2169.txt> (1999).
Accessed 12 Nov 1999.

Organization site

ISSN International Centre: The ISSN register. <http://www.issn.org> (2006).
Accessed 20 Feb 2007.

Dataset with persistent identifier

Zheng L-Y, Guo X-S, He B, Sun L-J, Peng Y, Dong S-S, et al. Genome data from sweet and grain sorghum (*Sorghum bicolor*). GigaScience Database.
2011. <http://dx.doi.org/10.5524/100012>.

Figures, tables and additional files

See [General formatting guidelines](#) for information on how to format figures, tables and additional files.

Section 3 Draft article

Evaluation of the anaesthetic theatre educational environment at the University of the Witwatersrand

Saad Khan

Juan Scribante¹

Helen Perrie¹

Lionel Green-Thompson²

¹Department of Anaesthesiology, School of Clinical Medicine, Faculty of Health Sciences, University of the Witwatersrand

²Dean, School of Medicine, Sefako Makgatho Health Sciences University

Corresponding Author

S Khan

Department of Anaesthesiology
Chris Hani Baragwanath Academic Hospital
26 Chris Hani Rd
Diepkloof, Soweto
Johannesburg
1860

saadkhan@live.co.za

0119330967

Abstract

Background

The educational environment impacts on various aspects of students' professional development and well-being and is an important aspect of medical education programmes. Limited research investigating the theatre educational environment has been identified in South Africa and there is limited understanding of this environment at the University of the Witwatersrand (Wits). This study aims to describe the educational environment in theatre for registrars in the Department of Anaesthesiology at Wits.

Methods

A prospective, descriptive study design was followed, involving anaesthetic registrars at Wits, using the adapted Anaesthetic Theatre Educational Environment Measure (ATEEM) questionnaire between April and June 2019. A convenience sampling method was implemented to administer the anonymous questionnaire. Categorical variables were described using numbers and percentages. Descriptive statistics were used to calculate the total scores. The independent t-test or analysis of variance test was used to make comparisons.

Results

A total of 85 (78.7%) anaesthetic registrars participated in this study. The mean total (SD) adapted ATEEM score was 116.5 (16.9) out of a total of 164. The total score for male and female registrars was 118.4 (13.5) and 115.3 (18.7) respectively ($p=0.419$). First-year registrars scored 121.6 (14.3), second years 111.1 (19.0), third years 111.4 (14.6) and fourth years 122.3 (18.7) ($p=0.003$). Junior and senior registrars scored 117.1 (17.0) and 115.7 (17.1) respectively ($p=0.708$). The three hospitals were scored 112.3 (19.5), 119.8 (16.4) and 115.4 (12.0) respectively ($p=0.187$). The mean scores for the five domains were autonomy 25.4/32 (3.1), perception of atmosphere 31.6/44 (5.4), workload/supervision/support 17.3/28 (3.5), perception of teachers and teaching 14.3/20 (2.9), and learning opportunities and orientation to learning 27.9/40 (5.1). The autonomy domain was assessed as being excellent while all the other domains were assessed as more positive than negative, but with room for improvement.

Conclusion

The theatre educational environment is perceived as more positive than negative, but with room for improvement. All the domains, except autonomy, require attention to further improve the educational environment. With the availability of a validated instrument to assess the educational environment objectively and quantitatively, regular quality assessments of the educational environment should be included in the training institution's practice.

Keywords

Anaesthetic Theatre Educational Environment Measure; anaesthesiology registrars; ATEEM; educational environment.

Background

Anaesthesiology is a branch of medicine involved with the care of surgical patients before, during and after surgery as well as the management of pain (1). Training to become an anaesthesiologist is one of the many domains of postgraduate medical education that can be pursued. The World Federation for Medical Education (WFME) (2) defines postgraduate medical education as “the phase in which doctors develop competencies under supervision towards independent practice after completion of their basic medical qualification”. The objective of any postgraduate medical education programme is to produce specialists who can provide the highest quality of care to their patients (2).

An important development in medical training programmes since the year 2000 has been the move towards competency-based education, “the notion that an expert physician is defined by a broad set of identified competencies” (3). Many competency frameworks that outline these core competencies have been developed. Examples of these include the Accreditation Council for Graduate Medical Education (ACGME) in the United States of America (4), Canadian Medical Education Directives for Specialists (CanMEDS) (5), and Tomorrow’s Doctor in the United Kingdom (6). These frameworks have been adopted and adapted by countries all over the world (3).

One of the most important factors determining the acquisition of the identified competencies by the different frameworks is the quality of the training programme. It is for this reason that the WFME has shown a great deal of interest in the quality assessment and improvement of education programmes. The WFME has identified the educational environment as a factor that plays a pivotal role in the quality of postgraduate education programmes (2). A good educational environment is therefore critical to successful postgraduate training (7, 8).

According to the American Medical Association (9), the educational environment is “a social system that includes the learner (including the external relationships and other factors affecting the learner), the individuals with whom the learner interacts, the setting(s) and purpose(s) of the interaction, and the formal and informal rules/policies/norms governing the interaction.”

How the educational environment is perceived is important because an environment that is conducive to learning is considered to be a learning agent that stimulates the learning process (10) and the accomplishment of goals and objectives (11) necessary for quality and successful postgraduate training (7, 8). The link between the educational environment and the quality of the education programme illustrates the need for training institutions to become more accountable for ensuring the necessary supportive educational environment for their trainees by regularly performing quality assessments of the educational environment (11).

Many instruments have been developed over the years to help with assessments of the educational environment of teaching programmes, but only a few instruments specifically assess the quality of the unique educational environment in the hospital setting (12). These instruments include the Dundee Ready Education Environment Measure (DREEM) (13), the Postgraduate Hospital Educational Environment Measure (PHEEM) (14), the Surgical Theatre Educational Environment Measure (STEEM) (15) and the Anaesthetic Theatre Educational Environment Measure (ATEEM) (16).

The medical and educational literature has shown that the quality of the educational environment plays a role in effective learning (16), quality training (7, 8), career satisfaction (17, 18), academic achievements (18, 19), burnout rates (20), and the levels of engagement and motivation (21-23). Anaesthesiology registrars spend most of their time in theatre and this is a unique educational environment in which most of their training occurs. The ATEEM is a specific instrument for the objective measurement of the anaesthetic theatre educational environment (16).

Limited research investigating the anaesthetic theatre educational environment has been identified internationally (16, 24, 25) and in South Africa. The quality of the theatre educational environment for anaesthesiology registrars at the University of the Witwatersrand (Wits) is yet to be explored quantitatively. However, in light of the fact that a supportive learning environment is fundamental to the professional development, moral development and well-being of anaesthetic trainees, this educational environment needs to be assessed to ultimately ensure

a quality postgraduate medical education programme that produces competent specialists that provide the safest and highest quality of care to patients.

The aim of this study was to describe the educational environment in theatre for anaesthesiology registrars in the Department of Anaesthesiology at Wits.

Methods

A prospective, contextual, descriptive research design was followed in this study. The study was conducted in the Department of Anaesthesiology, affiliated to the Faculty of Health Sciences of Wits in Johannesburg, South Africa. The staff complement of the department is 74 consultants, 108 registrars and 22 medical officers. Three of the hospitals on the academic training platform were included in this study, two are central hospitals and one is a tertiary hospital. These hospitals were labelled A, B and C.

The study population consisted of all registrars who were willing to participate and had completed at least three months of registrar training in the Department of Anaesthesiology at Wits. A junior registrar was defined as one who had completed more than three months but less than two years of training and a senior registrar as one who had completed two or more years of training. A convenience sampling method was used. The sample size was realised by the response rate. A minimum response rate of 60% (65 participants) was considered acceptable (26).

The study tool was an adapted version of the ATEEM questionnaire which was developed by Holt and Roff (16). Permission to use and to adapt the ATEEM questionnaire was granted by Roff.

The original ATEEM questionnaire consists of 40 items. The original questionnaire was adapted, in consultation with an anaesthesiologist with expertise and experience in medical education, to contextualise it to the South African environment. One further item, asking about the presence of racial discrimination, was added to the original ATEEM questionnaire. The reason for this is that racial discrimination remains an ongoing problem in South Africa. According to a survey conducted in 2015, the majority of South African citizens (56%) believe that they are treated unequally by employers due to race (27).

The adapted ATEEM questionnaire used in this study had a total of 41 items pertaining to the theatre educational environment. The data for this study were collected at academic meetings between April and June 2019 with the anonymous self-administered questionnaire. The adapted ATEEM questionnaire assessing the theatre educational environment of the most recent training hospital where the participant had completed a three-month general rotation took approximately 20 minutes to complete. Upon completion, the questionnaires were folded and placed in a sealed box at the exit of the meeting venue.

The level of agreement with each statement was rated using a 5-point Likert scale ranging from “Strongly agree” to “Strongly disagree”. The 41 items were clustered into five domains. These domains were autonomy (8 items), perception of atmosphere (11 items), workload, supervision and support (7 items), perceptions of teachers and teaching (5 items), and learning opportunities and orientation to learning (10 items).

Data were entered into a Microsoft Excel spreadsheet and were analysed using the statistical program STATA (StataCorp, USA) version 15. Each of the 41 items which form part of the questionnaire was allocated a score ranging from 0 – 4 based on the level of agreement with each statement.

Three of the 41 items (4, 24 and 41) were negative statements and reversed scoring applied to these items. A maximum score of 164 was possible for the questionnaire. Categorical variables were described using numbers and percentages. The total score was reported on an interval scale. The interval scale was as follows:

- 0 – 41 Very poor educational environment
- 42 – 82 Plenty of problems with the educational environment
- 83 – 123 More positive than negative, but there is room for improvement
- 124 – 164 Excellent educational environment (14).

The score for each of the five domains was also calculated and reported using an interval scale which placed the total score into one of four categories (very poor,

plenty of problems, more positive than negative but with room for improvement and excellent). To determine the range of scores that formed each category, the total score possible for each domain was divided into four equal portions. Incomplete questionnaires were excluded from the study. The normally distributed data were described using means and standard deviations. Comparisons between junior and senior registrar scores and the scores of male and female registrars were done using the independent t-test. Comparisons between the scores for each year of training and the scores for the different hospitals were done using the analysis of variance (ANOVA) test and the Tukey's test was performed if required. A p-value of <0.05 was considered statistically significant. The internal reliability of the instrument was measured using the Cronbach's alpha coefficient. A Cronbach's alpha of 0.7 or more was considered an acceptable internal reliability measurement (28).

Results

At the time of data collection, all 108 registrars had completed more than three months of training. A total of 105 questionnaires were distributed during the data collection period. Three registrars were inaccessible during the time of data collection. A total of 90 (85.7%) questionnaires were returned. Five (4.8%) questionnaires were excluded due to being incomplete, and therefore 85 (81%) questionnaires were included in the study, representing 78.7% of anaesthetic registrars in the department.

The characteristics of the respondents are illustrated in Table 1.

Table 1 Characteristics of respondents

Characteristic	n (%)
Sex	
Male	32 (37.6)
Female	53 (62.4)
Year of training	
1 st	27 (31.8)
2 nd	20 (23.5)
3 rd	23 (27.1)
≥ 4 th	15 (17.6)
Hospital at which a three-month rotation was last completed	
A	28 (32.9)
B	41 (48.2)
C	16 (18.8)

The Cronbach's alpha for the questionnaire was calculated to be 0.935. According to George and Mallery's (28) rule of thumb, this indicated an excellent internal reliability of the instrument.

The mean total (SD) adapted ATEEM score for all respondents was 116.5 (16.9) out of a total of 164. The distribution of all the mean total adapted ATEEM scores obtained is shown in Table 2.

Table 2 Distribution of adapted ATEEM scores of respondents

Description of the theatre educational environment	n (%)
Very poor educational environment	0 (0)
Plenty of problems with the educational environment	2 (2.4)
More positive than negative but room for improvement	57 (67.1)
Excellent educational environment	26 (30.6)

The score for each domain of the questionnaire is illustrated in Table 3.

Table 3 Score for each domain of the questionnaire

Domain	Maximum score possible	Mean Score	SD	Score Percentage (%)
Autonomy	32	25.4	3.1	79.4
Perception of atmosphere	44	31.6	5.4	71.8
Workload, supervision and support	28	17.3	3.5	61.8
Perception of teachers and teaching	20	14.3	2.9	71.5
Learning opportunities and orientation to learning	40	27.9	5.1	69.8

The autonomy domain was assessed as being excellent (scoring between 25 and 32) while all the other domains were assessed as more positive than negative, but with room for improvement.

The comparison between the total adapted ATEEM score and sex, seniority, year of training and hospital is illustrated in Table 4.

Table 4 Adapted ATEEM score comparison between characteristics

Characteristic	n (%)	Mean (SD)	p-value
Sex			
Male	32 (37.6)	118.4 (13.5)	0.419
Female	53 (62.4)	115.3 (18.7)	
Seniority			
Junior	47 (55.3)	117.1 (17.0)	0.708
Senior	38 (44.7)	115.7 (17.1)	
Year of training			
1 st	27 (31.8)	121.6 (14.3)	0.003
2 nd	20 (23.5)	111.1 (19.0)	
3 rd	23 (27.1)	111.4 (14.6)	
4 th	15 (17.6)	122.3 (18.7)	
Hospital at which a three-month rotation was last completed			
A	28 (32.9)	112.3 (19.5)	0.187
B	41 (48.2)	119.8 (16.4)	
C	16 (18.8)	115.4 (12.0)	

The scores of the first- and fourth-year registrars showed a statistically significant difference compared to the second- and third-year registrars, with the former scoring significantly higher.

Further comparison of the total score for each domain of the questionnaire between the different hospitals was performed. These results are illustrated in Table 5.

Table 5 Adapted ATEEM score for each domain at the different hospitals

	Hospital			
Domain	A	B	C	p-value
Autonomy	25.0	25.6	25.5	0.748
Perception of atmosphere	29.7	32.2	33.5	0.050
Workload, supervision and support	16.9	18.0	15.9	0.124
Perception of teachers and teaching	13.0	15.3	14.4	0.004
Learning opportunities and orientation to learning	27.7	28.8	26.1	0.199

Hospital A scored the lowest for the domains of autonomy, perception of atmosphere, and perception of teachers and teaching. Hospital C scored the lowest for the domains of learning opportunities and orientation to learning and workload, supervision and support.

A statistically significant difference was observed between the perception of teachers and teaching domain at Hospital A and Hospital B.

The results for the question pertaining to racial discrimination are illustrated in Table 6.

Table 6 Scores for racial discrimination in the training post

Presence of racial discrimination	n (%)
Strongly agree	5 (5.9)
Agree	13 (15.3)
Neutral	38 (44.7)
Disagree	19 (22.4)
Strongly disagree	10 (11.8)

Discussion

This study found that the anaesthetic theatre educational environment at Wits was perceived as more positive than negative, but with room for improvement. No

other South African study evaluating the educational environment quantitatively could be identified.

A qualitative study (25) in 2017 analysing registrars' experience of their training concluded that overall the Wits Department of Anaesthesiology was a positive place in which to learn, similar to the findings of this study.

Three international studies that used the ATEEM instrument in the United Kingdom (UK) (16), which is a developed country, and in Pakistan (24) and Iran (29), which are developing countries, were used to discuss the findings of this study. Only the public sector scores of the Pakistani study (24) were used as training of the respondents at Wits only takes place in the public sector. To make comparisons more accurate, the mean total ATEEM score in this section was calculated after removing item 41, this study's adaptation of the ATEEM.

The mean total ATEEM score of this study after removal of the adaptation was 114 out of 160 and this score was comparable to the studies in the UK (16), Iran (29) and the public sector of Pakistan (24) with scores of 117, 114 and 109 respectively. The mean total score for all three studies fell into the same category of more positive than negative, but with room for improvement.

When comparing the scores of the domains of the ATEEM between this study and the studies in Iran (29) and Pakistan (24), all three studies had the same highest and lowest scoring domains. Autonomy was the highest scoring domain, while workload, supervision and support was the lowest scoring domain. This illustrates that anaesthetic trainees in developing countries encounter similar factors that promote or inhibit a conducive anaesthetic theatre educational environment.

The domains of autonomy and learning opportunities and orientation to learning of this study scored higher than in the three international studies (16, 24, 29). The possible reason for the higher scoring of the autonomy domain is the level of responsibility given to training doctors in the South African health system and the accountability for the care given to patients (30). With regard to the learning opportunities and orientation to learning domain, the patient load with varieties of pathology allows for workplace-based learning and the opportunity for exposure to a large number and variety of practical procedures (31).

The workload, supervision and support domain of this study scored lower than the three international studies (16, 24, 29). The possible reasons for this domain scoring lower are the increased patient loads and the staff shortages in the South African public hospitals (32). Furthermore, the ratio of consultants to registrars is not regulated for training programmes in South Africa and this may contribute to this domain scoring lower.

Both this study, the Pakistani study (24) and the Iranian study (29) found no statistically significant difference in the scores based on the sex of the respondents. The study conducted in the UK did not analyse differences in scores between male and female respondents. The overall educational environment is therefore similarly experienced by both male and female respondents.

Similar to this study, the study conducted in the UK (16) found differences in scores between the different years of registrar training. This study, as well as the UK study, found a drop in the scores between the first and second registrar training years. In both studies, the second year of registrar training scored the lowest when compared to the first, third and fourth years. In contrast to this study, there was a significant improvement in scores from respondents in their third year, with the third year of registrar training scoring the highest in the UK study. In this study, the scores between the second and third years were similar and a significant improvement was seen from third- to fourth-year scores, resulting in the fourth year of registrar training scoring the highest. No reasons were provided for these possible differences in scores observed in the UK study.

The reasons for these differences in this study could be attributed to a few possible reasons based on anecdotal evidence. Firstly, registrars in their first year receive more direct supervision and support from consultants, who are often more lenient with registrars starting their training. Registrars starting their training are often paired with more senior registrars, providing them with more support and teaching in the theatre environment. Final-year registrars are also given more attention and teaching as they are being prepared for their examinations. Secondly, the second and third years of training are stressful and demanding. It is the start of the specialist rotations such as cardiothoracic, neurosurgery and vascular, there is a steep learning curve and increase in responsibilities, and the

bulk of the compulsory research component of the training programme takes place during these years.

The three lowest scoring questions in this study were: “There is an informative anaesthetic trainee handbook”, “Whenever I should participate in formal educational programmes, I get relief from theatre duties” and “My workload in the hospital is manageable”. Similarly, the study conducted by Cuthbert (25) concluded that some of the major shortcomings of the current learning environment according to registrars was the lack of relief from theatre duties for formal teaching and the workload in the hospitals. There is no informative trainee handbook or equivalent document to guide the training programme of anaesthesiology registrars at Wits. Therefore, registrars resort to compiling their own document.

Sexual, gender and racial discrimination in the workplace are issues that have been receiving increasing attention. This study found that 20% of respondents agreed to the presence of sexual or gender discrimination and 21% agreed to the presence of racial discrimination. Of the respondents, 45% were neutral with regard to the presence of sexual, gender and racial discrimination. Although most respondents in this study remained neutral or disagreed with regard to the sexual, gender and racial discrimination questions, these are still important social issues that need to be continuously addressed. In the qualitative study by Cuthbert (25), very few narratives specific to sexual, gender or racial discrimination were voluntarily offered and, according to the author, this lack of commentary suggested that sexual, gender and racial discrimination were sensitive but less pertinent issues that require further investigation.

The possible limitations of this study are that this study was contextual to the Department of Anaesthesiology at Wits, and therefore the results of the study may not be generalisable to anaesthesiology departments at other institutions. Furthermore, the ATEEM instrument is unidimensional as it assesses only the registrars’ perception of the educational environment and does not assess the perception of the educational environment by educators and other stakeholders.

Conclusion

The theatre educational environment is perceived as more positive than negative, but with room for improvement. All the domains, except autonomy, require attention to further improve the educational environment. With the availability of a validated instrument to assess the educational environment objectively and quantitatively, regular quality assessments of the educational environment should be included in the training institution's practice to ultimately produce competent specialists that provide the safest and highest quality of care to patients.

List of abbreviations

ACGME	Accreditation Council for Graduate Medical Education
ATEEM	Anaesthetic Theatre Educational Environment Measure
CanMEDS	Canadian Medical Education Directives for Specialists
DREEM	Dundee Ready Education Environment Measure
PHEEM	Postgraduate Hospital Educational Environment Measure
STEEM	Surgical Theatre Educational Environment Measure
UK	United Kingdom
WFME	World Federation for Medical Education
Wits	University of the Witwatersrand

Declarations

Ethics approval and consent to participate

The study was approved by the Human Research Ethics Committee (Medical) and Graduate Studies Committee of the University of the Witwatersrand (protocol number M181049).

Completion of the questionnaire was voluntary and informed consent was implied on the return of the questionnaire.

Consent for publication

Not applicable

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

Funding

There was no funding. Our own financial resources were used to conduct this study.

Authors' contributions

All authors contributed to the conception and protocol development of this study.

SK collected the data.

Data analyses were performed by SK, HP and JS.

SK drafted the manuscript.

All authors read and approved the final manuscript.

Acknowledgements

This research was done in partial fulfilment of a Master of Medicine degree.

References

1. American Society of Anesthesiologists. What is anesthesiology? [Internet]. Washington DC, USA: American Society of Anesthesiologists [Accessed: 30/06/2018]. Available from: <http://www.asahq.org/lifeline/types%20of%20anesthesia/what%20is%20anesthesiology>.
2. World Federation for Medical Education. Postgraduate medical education. WFME global standards for quality improvement [Internet]. Copenhagen, Denmark: World Federation for Medical Education; 2015 [Accessed: 30/08/2018]. Available from: <http://wfme.org/publications/wfme-global-standards-for-quality-improvement-pgme-2015/?wpdmdl=884';return>.
3. Norman G, Norcini J, Bordage G. Competency-based education: Milestones or millstones? J Grad Med Educ. 2014;6(1):1-6. doi:10.4300/JGME-D-13-00445.1.
4. Batalden P, Leach D, Swing S, Dreyfus H, Dreyfus S. General competencies and accreditation in graduate medical education. Health Aff. 2002;21(5):103-11. doi:10.1377/hlthaff.21.5.103.
5. The Royal College of Physicians and Surgeons of Canada. CanMEDS [Internet]. Ottawa, Canada: The Royal College of Physicians and Surgeons of Canada [Accessed: 30/08/2018]. Available from: <http://canmeds.royalcollege.ca/en/about/history>.
6. Rubin P, Franchi-Christopher D. New edition of Tomorrow's Doctors. Med Teach. 2002;24(4):368-9. doi:10.1080/0142159021000000816.
7. Roff S, McAleer S. What is educational climate? Med Teach. 2001;23(4):333-4. doi:10.1080/01421590120063312.
8. Kendall ML, Hesketh EA, Macpherson SG. The learning environment for junior doctor training: What hinders, what helps. Med Teach. 2005;27(7):619-24. doi:10.1080/01421590500069710.

9. American Medical Association. Initiative to transform medical education, phase 3: Program implementation. Strategies for transforming the medical education learning environment [Internet]. Chicago, USA: American Medical Association; 2007 [Accessed: 01/09/2018]. Available from: http://med2.uc.edu/Libraries/Medical_Education_Documents/AMA_ITME_Project.sflb.ashx.
10. Tomietto M, Comparcini D, Saarikoski M, Simonetti V, Cicolini G. Multilevel perspectives in clinical learning environments' assessment: An insight on levels involved in planning nursing education. *J Nurs Educ Pract*. 2014;4(12):42-50. doi:10.5430/jnep.v4n12p42.
11. Hoff TJ, Pohl H, Bartfield J. Creating a learning environment to produce competent residents: The roles of culture and context. *Acad Med*. 2004;79(6):532-40. doi:10.1097/00001888-200406000-00007.
12. Soemantri D, Herrera C, Riquelme A. Measuring the educational environment in health professions studies: A systematic review. *Med Teach*. 2010;32(12):947-52. doi:10.3109/01421591003686229.
13. Roff S, McAleer S, Harden RM, Al-Qahtani M, Ahmed AU, Deza H, et al. Development and validation of the Dundee ready education environment measure (DREEM). *Med Teach*. 1997;19(4):295-9. doi:10.3109/01421599709034208.
14. Roff S, McAleer S, Skinner A. 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*. 2005;27(4):326-31. doi:10.1080/01421590500150874.
15. Cassar K. Development of an instrument to measure the surgical operating theatre learning environment as perceived by basic surgical trainees. *Med Teach*. 2004;26(3):260-4. doi:10.1080/0142159042000191975.
16. Holt MC, Roff S. Development and validation of the Anaesthetic Theatre Educational Environment Measure (ATEEM). *Med Teach*. 2004;26(6):553-8. doi:10.1080/01421590410001711599.

17. Cross V, Hicks C, Parle J, Field S. Perceptions of the learning environment in higher specialist training of doctors: Implications for recruitment and retention. *Med Educ*. 2006;40(2):121-8. doi:10.1111/j.1365-2929.2005.02382.x.
18. Genn JM. AMEE Medical Education Guide No. 23 (Part 1): Curriculum, environment, climate, quality and change in medical education: A unifying perspective. *Med Teach*. 2001;23(4):337-44. doi:10.1080/01421590120063330.
19. Shimizu T, Tsugawa Y, Tanoue Y, Konishi R, Nishizaki Y, Kishimoto M, et al. The hospital educational environment and performance of residents in the General Medicine In-Training Examination: A multicenter study in Japan. *Int J Gen Med*. 2013;6:637-40. doi:10.2147/IJGM.S45336.
20. Llera J, Durante E. Correlation between the educational environment and burn-out syndrome in residency programs at a university hospital. *Arch Argent Pediatr*. 2014;112(1):6-11. doi:10.1590/S0325-00752014000100003.
21. Tefera YA, Yirtaw TG, Mamo DB. Evaluation of the learning environment for residency training in Saint Paul's Hospital Millennium Medical College. *Ethiop Med J*. 2017;56(1):11-6. doi:10.1111/j.1365-2929.2006.02499.
22. Idon P, Suleiman I, Olasoji O, Mustapha Z, Abba H. Postgraduate trainees' perceptions of the learning environment in a Nigerian teaching hospital. *Afr J Health Prof Educ*. 2017;9(3):116-22. doi:10.7196/AJHPE.2017.v9i3.786.
23. Bakhshialiabad H, Bakhshi M, Hassanshahi G. Students' perceptions of the academic learning environment in seven medical sciences courses based on DREEM. *Adv Med Educ Pract*. 2015;6:195-203. doi:10.2147/AMEP.S60570.
24. Zeb H, Rehman A, Niazi A. Assessment of learning environment in anesthesia by using ATEEM tool. *Anaesth Pain Intensive Care*. 2017;21(3):354-9. doi:1080/01421590120063312.
25. Cuthbert S. Anaesthesiology registrars' experience of their training at the University of the Witwatersrand: A Qualitative study [Research report]: University of the Witwatersrand, Johannesburg; 2017.

26. Schutt R. Investigating the social world: The process and practice of research. 2nd ed. Thousand Oaks, California: Pine Forge Press; 1999.
27. Lekalake R, Nkomo S. South Africans generally tolerant but report racial discrimination by employers and courts [Internet]. Cape Town, South Africa: Afrobarometer; 2016 [Accessed: 20/09/2018]. Available from: http://afrobarometer.org/sites/default/files/publications/Dispatches/ab_r6_dispatch_no84-south-africa-discrimination.pdf.
28. George D, Mallery P. SPSS for Windows step by step: Answers to selected exercises. 4th ed. Boston, USA: Allyn and Bacon; 2003.
29. Koohpayehzadeh J, Mirzaei Z, Zahedi H, Alebouyeh MR, Naghizadeh Moogari Z. Psychometric properties of the Persian version of the Anesthetic Trainee Theatre Educational Environment Measure (ATEEM). Med J Islam Repub Iran. 2019;33:13. doi:10.34171/mjiri.33.13.
30. Reardon C, Enigbokan O, George G. British doctors' experiences of working in rural South Africa: The London GP out of programme experience. Health SA Gesondheid. 2014;19(1):1-10. doi:10.4102/hsag.v19i1.789.
31. Reardon C, George G, Enigbokan O. The benefits of working abroad for British general practice trainee doctors: The London deanery out of programme experience in South Africa. BMC Med Educ. 2015;15(1):6-13. doi:10.1186/s12909-015-0447-6.
32. Von Holdt K, Murphy M. State of the Nation: South Africa 2007. Cape Town, South Africa: HSRC Press; 2007.

Section 4 Proposal

Evaluation of the anaesthetic theatre educational environment at the University of the Witwatersrand

Saad Khan

0702480Y

Supervisor	Helen Perrie Department of Anaesthesiology
Co-supervisor	Juan Scribante Department of Anaesthesiology
Co-supervisor	Lionel Green-Thompson Assistant Dean: Teaching and learning

4.1 Introduction and problem statement

Anaesthesiology is a branch of medicine involved with the care of surgical patients before, during and after surgery as well as the management of pain (1). Training to become an anaesthesiologist is one of the many domains of postgraduate medical education that can be pursued. The World Federation for Medical Education (WFME) (2) defines postgraduate medical education as “the phase in which doctors develop competencies under supervision towards independent practice after completion of their basic medical qualification”. The objective of any postgraduate medical education programme is to produce specialists who can provide the highest quality of care to their patients (2).

An important development in medical training programmes since the year 2000 has been the move towards competency-based education, “the notion that an expert physician is defined by a broad set of identified competencies” (3). Many competency frameworks that outline these core competencies have been developed. Examples of these include the Accreditation Council for Graduate Medical Education (ACGME) in the United States of America (4), Canadian Medical Education Directives for Specialists (CanMEDS) (5), and Tomorrow’s Doctor in the United Kingdom (6). These frameworks have been adopted and adapted by countries all over the world (3).

One of the most important factors determining the acquisition of the identified competencies by the different frameworks is the quality of the training programme. It is for this reason that the WFME has shown a great deal of interest in the quality assessment and improvement of education programmes. The WFME has identified the educational environment as a factor that plays a pivotal role in the quality of postgraduate education programmes (2). A good educational environment is therefore critical to successful postgraduate training (7, 8).

According to the American Medical Association (9), the educational environment is “a social system that includes the learner (including the external relationships and other factors affecting the learner), the individuals with whom the learner interacts, the setting(s) and purpose(s) of the interaction, and the formal and informal rules/policies/norms governing the interaction”.

How the educational environment is perceived is important because an environment that is conducive to learning is considered to be a learning agent that stimulates the learning process (10) and the accomplishment of goals and objectives (11) necessary for quality and successful postgraduate training (7, 8). The link between the educational environment and the quality of the education programme illustrates the need for training institutions to become more accountable for ensuring the necessary supportive educational environment for their trainees by regularly performing quality assessments of the educational environment (11).

Many instruments have been developed over the years to help with assessments of the educational environment of teaching programmes, but only a few instruments specifically assess the quality of the unique educational environment in the hospital setting (12). These instruments include the Dundee Ready Education Environment Measure (DREEM) (13), the Postgraduate Hospital Educational Environment Measure (PHEEM) (14), the Surgical Theatre Educational Environment Measure (STEEM) (15) and the Anaesthetic Theatre Educational Environment Measure (ATEEM) (16).

The medical and educational literature has shown that the quality of the educational environment plays a role in effective learning (16), quality training (7, 8), career satisfaction (17, 18), academic achievements (18, 19), burnout rates (20), and the levels of engagement and motivation (21-23). Anaesthesiology registrars spend most of their time in theatre and this is a unique learning environment in which most of their training occurs. The ATEEM is a specific instrument for the objective measurement of the anaesthetic theatre educational environment (16).

Three studies which were conducted in the United Kingdom (16), Iran (24) and Pakistan (25) utilised the ATEEM questionnaire and these studies revealed that respondents experienced the theatre educational environment more positively than negatively, but with room for improvement. A qualitative study at the University of the Witwatersrand (Wits) in 2017 by Cuthbert (26), found that overall the Wits Department of Anaesthesiology was a positive place in which to learn, but some anaesthesiology registrars experienced their environment as suboptimal and

described it as stressful, exhausting and competitive. Limited research investigating the anaesthetic theatre educational environment has been identified in South Africa. There is currently little understanding of the anaesthetic theatre educational environment at Wits.

4.2 Aim and objectives

4.2.1 Aim

The aim of this study is to describe the educational environment in theatre for anaesthesiology registrars in the Department of Anaesthesiology at Wits.

4.2.2 Objectives

The primary objective of this study is to assess the theatre educational environment using the adapted ATEEM questionnaire which includes the following domains:

- autonomy
- perceptions of atmosphere
- workload, supervision and support
- perceptions of teaching and teachers
- learning opportunities and orientation to learning.

The secondary objectives of this study are to compare the adapted ATEEM scoring between:

- junior and senior registrars
- each year of registrar training
- male and female registrars
- the different hospitals.

4.3 Research assumptions

The following definitions will be used in this study.

Registrar: is a qualified doctor who is registered with the Health Professions Council of South Africa as a trainee anaesthesiologist.

Junior registrar: is a registrar who has completed more than three months but less than two years of training.

Senior registrar: is a registrar who has completed two or more years of training.

ATEEM: is an instrument developed for the objective measurement of the educational environment in theatre for anaesthetic trainees (16).

4.4 Demarcation of study field

The study will be conducted in the Department of Anaesthesiology, affiliated to the Faculty of Health Sciences of Wits. The staff complement of the department is 74 consultants, 108 registrars and 22 medical officers. The hospitals on the central training platform of the Department of Anaesthesiology are:

- Charlotte Maxeke Johannesburg Academic Hospital, a 1200-bed central hospital
- Chris Hani Baragwanath Academic Hospital, a 2880-bed central hospital
- Helen Joseph Hospital, a 500-bed tertiary hospital
- Rahima Moosa Mother and Child Hospital, a 338-bed regional hospital.

4.5 Ethical considerations

Approval to conduct the study will be obtained from the Human Research Ethics Committee (Medical) and the Graduate Studies Committee of Wits. Further approval was obtained from the Head of Department of Anaesthesiology (Appendix 1). Permission to use and to adapt the ATEEM questionnaire for this study was granted by Roff, one of the developers of the ATEEM questionnaire (Appendix 2).

This study will use an anonymous self-administered questionnaire. Once the study is approved, registrars will be approached at departmental academic meetings, an explanation of the study will be given, and they will be invited to participate. Those agreeing to participate in the study will be given an information letter (Appendix 3),

outlining the purpose of the study and what will be required of them, as well as the questionnaire (Appendix 4). Completion of the questionnaire will be voluntary and consent will be implied on the return of the questionnaire.

Questionnaires will contain no identifying information. However, they will be numbered for the response rate calculation. Upon completion, the questionnaires will be folded and then placed in a sealed box at the exit of the meeting venue. Only the researcher and supervisors will have access to the raw data. These measures will ensure anonymity and confidentiality. The researcher is a registrar in the department and those completing the questionnaires are not subordinate.

Should the research reveal a suboptimal educational environment, the Head of the Department of Anaesthesiology will be made aware of the results.

The raw data will be stored securely in a locked cupboard for six years after completion of the study. The study will be conducted according to the principles of the Declaration of Helsinki (27) and the South African Guidelines for Good Clinical Practice (28).

4.6 Research methodology

4.6.1 Research design

A prospective, contextual, descriptive research design will be followed in this study.

In a prospective study, a selected population is followed over a period of time and thereafter an outcome is measured (29). This study will be a prospective study as the data will be collected at the time the study takes place.

A contextual study is one that takes place amongst a specific group or population referred to as a “small-scale world” (30). Examples of this can be a ward or a clinic in the hospital. This study is contextual as it will be conducted amongst registrars working in the Department of Anaesthesiology at Wits.

A descriptive study aims to examine certain characteristics of a population, without establishing a causal link, as they would naturally occur (29). This study will describe the current theatre educational environment that registrars experience.

4.6.2 Study population

The study population consists of all registrars that have completed at least three months of training in the Department of Anaesthesiology at Wits.

4.6.3 Study sample

Sample size

The sample size will be realised by the response rate. The Department of Anaesthesiology has a total of 108 registrars. Questionnaires will be administered to the entire accessible population. A minimum response rate of 60% is considered acceptable (31).

Sampling method

In this study, a convenience sampling method will be used. Convenience sampling is a method whereby participants who are readily available to the researcher will be enrolled (29). All registrars who have completed at least three months of training in the Department of Anaesthesiology will be invited to participate in the study.

Inclusion and exclusion criteria

The inclusion criterion for this study is registrars agreeing to participate.

The exclusion criteria for this study are:

- incomplete questionnaires
- newly appointed registrars who have not yet completed a three-month rotation.

4.6.4 Data collection

Questionnaire development

After reviewing the literature, a questionnaire that was developed by Holt and Roff (16) to assess the educational environment for trainee anaesthesiologists in theatre was identified. Permission to use and to adapt the questionnaire was obtained from Roff (Appendix 2). The ATEEM questionnaire consists of 40 items. The ATEEM questionnaire was adapted, in consultation with an anaesthesiologist with expertise and experience in medical education, to contextualise it to the South African environment.

One further item, asking about the presence of racial discrimination, was added to the original questionnaire. The reason for this is that racial discrimination remains an ongoing problem in South Africa. According to a survey conducted in 2015, the majority of South African citizens (56%) believe that they are treated unequally by employers due to race (32).

The self-administered questionnaire consists of two sections. Section 1 will request the following demographic information from the participants:

- sex
- year of registrar training
- the last hospital at which they completed a three-month general rotation.

Section 2 will have a total of 41 statements pertaining to the theatre educational environment. The level of agreement with each statement will be rated using a 5-point Likert scale ranging from “Strongly agree” to “Strongly disagree”.

These 41 items are clustered into five domains:

- autonomy 8 items items 5, 10, 15, 20, 25, 29, 33, 36
- perceptions of atmosphere 11 items items 4, 9, 14, 19, 24, 28, 32, 35, 38, 40, 41
- workload, supervision and support 7 items items 3, 8, 13, 18, 23, 27, 31
- perception of teachers and teaching 5 items items 2, 7, 12, 17, 22
- learning opportunities and orientation to learning. 10 items items 1, 6, 11, 16, 21, 26, 30, 34, 37, 39

Data collection

Once all approvals that are required have been obtained, registrars will receive an explanation of the study and will be invited to participate in the study at departmental academic meetings. Those agreeing to participate will receive the information letter (Appendix 3) and the questionnaire (Appendix 4). The questionnaire will take approximately 20 minutes to complete. The researcher will be available throughout to address any queries. Participants will be asked to fold and place the questionnaires in a sealed data collection box at the exit of the meeting venue.

4.6.5 Data analysis

Data will be entered into a Microsoft Excel spreadsheet and will be analysed using the statistical program STATA (StataCorp) version 15. Each of the 41 items which form part of the questionnaire will be allocated a score ranging from 0 – 4 based on the level of agreement with each statement. Scoring will be as follows:

- strongly agree 4
- agree 3
- unsure 2
- disagree 1
- strongly disagree 0

Three of the 41 items (4, 24 and 41) are negative statements and reversed scoring applies to these items. A maximum score of 164 is possible for the questionnaire. Categorical variables will be described using numbers and percentages. The total score will be reported on an interval scale. The interval scale will be as follows:

- 0 – 41 Very poor educational environment
- 42 – 82 Plenty of problems with the educational environment
- 83 – 123 More positive than negative, but there is room for improvement
- 124 – 164 Excellent educational environment (14).

The score for each of the five domains will also be calculated and reported on an interval scale. Categorical variables will be described using numbers and percentages. Normally distributed data will be described using means and standard deviations and non-normally distributed data using medians and interquartile ranges. Comparisons between junior and senior registrar scores and the scores of male and female registrars will be done using the independent t-test or Mann Whitney test depending on the distribution of the data. Comparisons between the scores for each year of training and the scores for the different hospitals will be done using the analysis of variance (ANOVA) test and post-hoc tests will be performed if required. A p-value of <0.05 will be considered statistically significant.

4.7 Significance of the study

The foundation for improving the health and safety of patients starts with the education of health care providers (22). Adult learning theories have emphasised that teaching is as much about the environment in which learning takes place as it is about imparting knowledge (33).

The educational environment is a major contributor to the quality of postgraduate medical education programmes and has been receiving increasing attention over the years (2, 18, 22). In addition to affecting students' academic achievements and success (18, 19), the educational environment may impact on students' motivation (21-23), behaviour (22, 34), attitude (22, 34), well-being and happiness (22),

burnout rates (20), career satisfaction (17, 18), and studying and learning approaches (16, 35, 36).

The quality of the theatre educational environment for anaesthesiology registrars at Wits is yet to be explored quantitatively. However, in light of the fact that a supportive learning environment is fundamental to the professional development, moral development and well-being of anaesthetic trainees, this educational environment needs to be assessed to ultimately ensure a quality postgraduate medical education programme that produces competent specialists that provide the safest and highest quality of care to patients.

4.8 Validity and reliability of the study

According to Botma et al. (37) validity of a study is defined as “the degree to which a measurement represents a true value” and the reliability of a study refers to the consistency with which a measure is achieved and the extent to which random error occurs.

The validity and reliability of this study will be ensured by:

- applying an appropriate study design
- having a representative study sample
- inviting all registrars to participate, thereby eliminating selection bias
- using a questionnaire that has been previously validated and now adapted for the South African context
- the questionnaires being completed in a non-threatening environment and by folding and placing questionnaires in a sealed box
- the researcher being available throughout to answer any questions
- data analysis being done in consultation with a biostatistician.

The internal reliability of the adapted ATEEM instrument will be measured using the Cronbach’s alpha coefficient. A Cronbach’s alpha of 0.7 or more is generally considered to be an acceptable internal reliability (38).

4.9 Potential limitations

The limitations of this study are that:

- the study will be contextual to the Department of Anaesthesiology at the University of the Witwatersrand, and therefore the results of the study may not be generalisable to anaesthesiology departments at other institutions.
- a convenience sampling method will be used. This method may not adequately represent the perceptions of all registrars in the department.

4.10 Project outline

4.10.1 Time frame

Activity	Aug 2018	Sept- Oct 2018	Nov 2018	Jan- Feb 2019	Mar- May 2019	Jun 2019	Jul- Aug 2019	Sept 2019
Literature review								
Proposal preparation								
Ethics and postgraduate submission								
Ethics and postgraduate approval								
Data collection								
Data analysis								
Draft article								
Submission								

4.10.2 Budget

Item	Number	Cost	Total
Printing	1000	R1/page	R1000
Binding	4	R200	R800
Total			R1800

The Department of Anaesthesiology will bear the cost of printing and paper for the proposal, ethics and postgraduate approvals.

4.11 References

1. American Society of Anesthesiologists. What is anesthesiology? [Internet]. Washington DC, USA: American Society of Anesthesiologists [Accessed: 30/06/2018]. Available from: <http://www.asahq.org/lifeline/types%20of%20anesthesia/what%20is%20anesthesiology>.
2. World Federation for Medical Education. Postgraduate medical education. WFME global standards for quality improvement [Internet]. Copenhagen, Denmark: World Federation for Medical Education; 2015 [Accessed: 30/08/2018]. Available from: <http://wfme.org/publications/wfme-global-standards-for-quality-improvement-pgme-2015/?wpdmdl=884';return>.
3. Norman G, Norcini J, Bordage G. Competency-based education: Milestones or millstones? J Grad Med Educ. 2014;6(1):1-6. doi:10.4300/JGME-D-13-00445.1.
4. Batalden P, Leach D, Swing S, Dreyfus H, Dreyfus S. General competencies and accreditation in graduate medical education. Health Aff. 2002;21(5):103-11. doi:10.1377/hlthaff.21.5.103.
5. The Royal College of Physicians and Surgeons of Canada. CanMEDS [Internet]. Ottawa, Canada: The Royal College of Physicians and Surgeons of Canada [Accessed: 30/08/2018]. Available from: <http://canmeds.royalcollege.ca/en/about/history>.
6. Rubin P, Franchi-Christopher D. New edition of Tomorrow's Doctors. Med Teach. 2002;24(4):368-9. doi:10.1080/0142159021000000816.
7. Roff S, McAleer S. What is educational climate? Med Teach. 2001;23(4):333-4. doi:10.1080/01421590120063312.
8. Kendall ML, Hesketh EA, Macpherson SG. The learning environment for junior doctor training: What hinders, what helps. Med Teach. 2005;27(7):619-24. doi:10.1080/01421590500069710.

9. American Medical Association. Initiative to transform medical education, phase 3: Program implementation. Strategies for transforming the medical education learning environment [Internet]. Chicago, USA: American Medical Association; 2007 [Accessed: 01/09/2018]. Available from: http://med2.uc.edu/Libraries/Medical_Education_Documents/AMA_ITME_Project.sflb.ashx.
10. Tomietto M, Comparcini D, Saarikoski M, Simonetti V, Cicolini G. Multilevel perspectives in clinical learning environments' assessment: An insight on levels involved in planning nursing education. *J Nurs Educ Pract*. 2014;4(12):42-50. doi:10.5430/jnep.v4n12p42.
11. Hoff TJ, Pohl H, Bartfield J. Creating a learning environment to produce competent residents: The roles of culture and context. *Acad Med*. 2004;79(6):532-40. doi:10.1097/00001888-200406000-00007.
12. Soemantri D, Herrera C, Riquelme A. Measuring the educational environment in health professions studies: A systematic review. *Med Teach*. 2010;32(12):947-52. doi:10.3109/01421591003686229.
13. Roff S, McAleer S, Harden RM, Al-Qahtani M, Ahmed AU, Deza H, et al. Development and validation of the Dundee ready education environment measure (DREEM). *Med Teach*. 1997;19(4):295-9. doi:10.3109/01421599709034208.
14. Roff S, McAleer S, Skinner A. 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*. 2005;27(4):326-31. doi:10.1080/01421590500150874.
15. Cassar K. Development of an instrument to measure the surgical operating theatre learning environment as perceived by basic surgical trainees. *Med Teach*. 2004;26(3):260-4. doi:10.1080/0142159042000191975.
16. Holt MC, Roff S. Development and validation of the Anaesthetic Theatre Educational Environment Measure (ATEEM). *Med Teach*. 2004;26(6):553-8. doi:10.1080/01421590410001711599.

17. Cross V, Hicks C, Parle J, Field S. Perceptions of the learning environment in higher specialist training of doctors: Implications for recruitment and retention. *Med Educ.* 2006;40(2):121-8. doi:10.1111/j.1365-2929.2005.02382.x.
18. Genn JM. AMEE Medical Education Guide No. 23 (Part 1): Curriculum, environment, climate, quality and change in medical education: A unifying perspective. *Med Teach.* 2001;23(4):337-44. doi:10.1080/01421590120063330.
19. Shimizu T, Tsugawa Y, Tanoue Y, Konishi R, Nishizaki Y, Kishimoto M, et al. The hospital educational environment and performance of residents in the General Medicine In-Training Examination: A multicenter study in Japan. *Int J Gen Med.* 2013;6:637-40. doi:10.2147/IJGM.S45336.
20. Llera J, Durante E. Correlation between the educational environment and burn-out syndrome in residency programs at a university hospital. *Arch Argent Pediatr.* 2014;112(1):6-11. doi:10.1590/S0325-00752014000100003.
21. Tefera YA, Yirtaw TG, Mamo DB. Evaluation of the learning environment for residency training in Saint Paul's Hospital Millennium Medical College. *Ethiop Med J.* 2017;56(1):11-6. doi:10.1111/j.1365-2929.2006.02499.
22. Bakhshialiabad H, Bakhshi M, Hassanshahi G. Students' perceptions of the academic learning environment in seven medical sciences courses based on DREEM. *Adv Med Educ Pract.* 2015;6:195-203. doi:10.2147/AMEP.S60570.
23. Idon P, Suleiman I, Olasoji O, Mustapha Z, Abba H. Postgraduate trainees' perceptions of the learning environment in a Nigerian teaching hospital. *Afr J Health Prof Educ.* 2017;9(3):116-22. doi:10.7196/AJHPE.2017.v9i3.786.
24. Koohpayehzadeh J, Mirzaei Z, Zahedi H, Alebouyeh MR, Naghizadeh Moogari Z. Psychometric properties of the Persian version of the Anesthetic Trainee Theatre Educational Environment Measure (ATEEM). *Med J Islam Repub Iran.* 2019;33:13. doi:10.34171/mjiri.33.13.
25. Zeb H, Rehman A, Niazi A. Assessment of learning environment in anesthesia by using ATEEM tool. *Anaesth Pain Intensive Care.* 2017;21(3):354-9. doi:1080/01421590120063312.

26. Cuthbert S. Anaesthesiology registrars' experience of their training at the University of the Witwatersrand: A Qualitative study [Research report]: University of the Witwatersrand, Johannesburg; 2017.
27. World Medical Association. WMA Declaration of Helsinki: Ethical principles for medical research involving human subjects. JAMA. 2013;310(20):2191. doi:10.1001/jama.2013.281053.
28. Department of Health. Guidelines for good practice in the conduct of clinical trials with human participants in South Africa [Internet]. Pretoria, South Africa: Department of Health; 2006 [Accessed: 27/09/2018]. Available from: www.kznhealth.gov.za/research/guideline1.pdf.
29. Brink H, Van der Walt C, Van Rensburg G. Fundamentals of research methodology for healthcare professionals. 3rd ed. Cape Town, South Africa: Juta; 2012.
30. De Vos A, Strydom H, Fouche C, Poggenpoel M, Schurink E, Schurink W. Research at grass roots. Pretoria, South Africa: Van Schaik; 1998.
31. Schutt R. Investigating the social world: The process and practice of research. 2nd ed. Thousand Oaks, California: Pine Forge Press; 1999.
32. Lekalake R, Nkomo S. South Africans generally tolerant but report racial discrimination by employers and courts [Internet]. Cape Town, South Africa: Afrobarometer; 2016 [Accessed: 20/09/2018]. Available from: http://afrobarometer.org/sites/default/files/publications/Dispatches/ab_r6_dispatch_no84-south-africa-discrimination.pdf.
33. Hutchinson L. ABC of learning and teaching: Educational environment. BMJ. 2003;326(7393):810. doi:10.1136/bmj.326.7393.810.
34. Al-Marshad S, Alotaibi G. Evaluation of clinical educational environment at King Fahad Hospital of Dammam University using the Postgraduate Hospital Education Environment Measure (PHEEM) inventory. Education in Medicine Journal. 2011;3(2):6-14. doi:10.5959/eimj.3.2.2011.or1.

35. Ramsden P, Entwistle NJ. Effects of academic departments on students' approaches to studying. *Br J Educ Psychol*. 1981;51(3):368-83. doi:10.1111/j.2044-8279.1981.tb02493.x.
36. Lizzio A, Wilson K, Simons R. University students' perceptions of the learning environment and academic outcomes: Implications for theory and practice. *Stud High Educ*. 2002;27(1):27-52. doi:10.1080/03075070120099359.
37. Botma Y, Greeff M, Mulaudzi FM, Wright SC. *Research in health sciences*. Cape Town, South Africa: Heinemann; 2010.
38. George D, Mallery P. *SPSS for Windows step by step: Answers to selected exercises*. 4th ed. Boston, USA: Allyn and Bacon; 2003.

4.12 Appendices

Appendix 1 Letter to the Head of Department of Anaesthesiology

HREC 2018

Dr S Khan

Department of Anaesthesiology

University of the Witwatersrand

saadkhan@live.co.za

25 September 2018

Dear Dr Lines

The purpose of this letter is to obtain permission to conduct a study for my M med in Anaesthesiology titled: **Evaluation of the anaesthetic theatre educational environment at the University of the Witwatersrand.**

The study will be conducted on all registrars working in the Department of Anaesthesiology at the University of the Witwatersrand. The aim of the study is to describe the educational environment in theatre for anaesthesiology registrars. This will be determined by means of a self-administered questionnaire.

Permission to conduct the study will be obtained from the from the Human Research Ethics Committee (Medical) and the Graduate Studies Committee of the University of the Witwatersrand.

Thanking you in advance for your assistance in this matter.

Sincerely

Dr Saad Khan

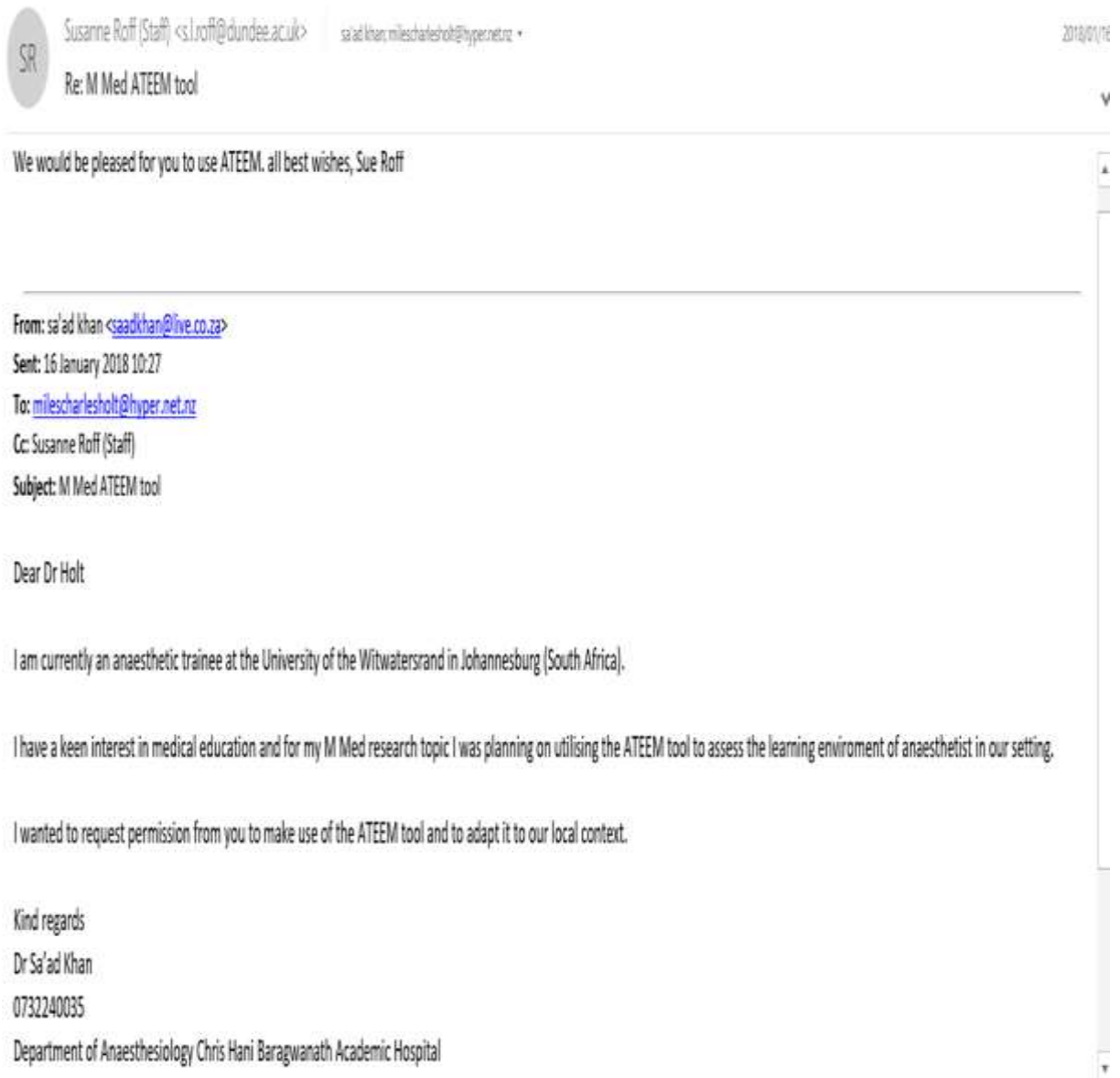
MBBCh (Wits) DA(SA)



Dr D Lines



Appendix 2 Permission to use the ATEEM questionnaire



Appendix 3 Study information sheet

Dear Colleague

Hello, my name is Saad Khan, and I am a registrar in the Wits Department of Anaesthesiology. I would like to invite you to participate in my M Med research study titled: **Evaluation of the anaesthetic theatre educational environment at the University of the Witwatersrand.**

The aim of this study is to describe the educational environment in theatre for anaesthesiology registrars in the Department of Anaesthesiology at the University of the Witwatersrand. This will be determined by a self-administered questionnaire. Completion of the questionnaire will provide an indication of the current theatre educational environment and could help with identifying problem areas and implementing strategies to improve the educational environment, to the benefit of current and future anaesthetic trainees.

Participation in the study is completely voluntary and consent will be implied on completion of the questionnaire. All information provided will remain strictly confidential and anonymous, as no personal details will be required and only the researcher and supervisors will have access to the raw data. There will be no penalty or repercussions for not participating in the study. There are no risks, costs and payments associated with the completion of the questionnaire.

The questionnaire should not take longer than 20 minutes to complete. All questionnaires, whether completed or not, should be folded and then returned by placing them in the sealed data collection box. The numbering of the questionnaires is simply for data capturing purposes and can in no way identify the participant. No incentives will be provided for completing the questionnaire.

Please ensure that you understand the above information prior to completing the questionnaire.

The Human Research Ethics Committee (HREC)(Medical) (M181049) and the Graduate Studies Committee of the University of the Witwatersrand have approved this study.

Any questions or concerns regarding this study can be directed to the following people:

- Professor C Penny (chairperson of the HREC): (011) 717 2301
Clement.Penny@wits.ac.za
- Zanele Ndlovu (HREC administrator): (011) 717 2700
Zanele.Ndlovu@wits.ac.za
- Rhulani Mukansi (HREC administrator): (011) 717 1234
Rhulani.Mukansi@wits.ac.za
- Saad Khan (researcher): 073 224 0035
saadkhan@live.co.za

Thank you for reading this study information sheet.

Dr. Saad Khan

October 2018

Appendix 4 Adapted Anaesthetic Theatre Educational Environment Measure (ATEEM) Questionnaire

Section 1- Demographic information

1.1 Sex	
Male	
Female	

1.2 Year of registrar training	
1 st year	
2 nd year	
3 rd year	
4 th year or more	

1.3 Before the current rotation, at which hospital did you <i>last complete a three-month general (non-specialist)</i> rotation?	
Chris Hani Baragwanath Academic Hospital	
Charlotte Maxeke Johannesburg Academic Hospital	
Helen Joseph/ Rahima Moosa Mother and Child Hospital	

Section 2- Adapted ATEEM questionnaire

Please indicate whether you Strongly Agree, Agree, are Unsure, Disagree or Strongly Disagree with the following statements as it applies to your own feelings about theatre teaching in the hospital where you **last completed a three-month general rotation.**

PLEASE ANSWER ALL QUESTIONS.

		STRONGLY AGREE	AGREE	NEUTRAL	DISAGREE	STRONGLY DISAGREE
1.	There are opportunities for learning all desired clinical skills					
2.	The teaching helps to develop my confidence					
3.	I receive effective supervision from the consultants					
4.	Surgeons do not like the noise of theatre teaching					
5.	Teaching is done at appropriate times not affecting vigilance					
6.	I receive theatre teaching in areas targeted at my learning needs					
7.	The teachers help to develop my competence					
8.	My consultants are accessible for advice					
9.	I experience friendly relations with my consultants in theatre					
10.	I am aware of my anaesthetic role in theatre					
11.	I have opportunities to learn and practise a variety of clinical procedures					
12.	The consultants in this hospital interact well with trainees					
13.	There is an informative anaesthetic trainee handbook					
14.	The people I work with are friendly					

		STRONGLY AGREE	AGREE	NEUTRAL	DISAGREE	STRONGLY DISAGREE
15.	I feel responsible and accountable for the care given to my patients					
16.	I am able to acquire adequate technical skills in this post					
17.	My consultants are fair in their evaluations					
18.	At this hospital I have access to help from more experienced colleagues					
19.	My consultants promote an atmosphere of mutual respect					
20.	I have an appropriate level of clinical responsibility					
21.	There are good opportunities for trainees who fail to complete their training satisfactorily					
22.	My consultants are clear in their teaching					
23.	Whenever I should participate in formal educational programmes, I get relief from theatre duties					
24.	There is sex or gender discrimination in this post					
25.	I am clear about the learning objectives of the theatre teaching session					
26.	There is a clinical training programme here that allows me to get first-hand experience in a range of procedures					
27.	I receive the necessary clinical supervision					
28.	I feel part of a team working here					

		STRONGLY AGREE	AGREE	NEUTRAL	DISAGREE	STRONGLY DISAGREE
29.	I discuss the anaesthetic plan of cases with the consultant					
30.	I have the opportunity to acquire the appropriate practical procedures for my level of training (e.g. fibreoptic intubation/ nerve blocks)					
31.	My workload in this hospital is manageable					
32.	I have good collaboration with theatre staff					
33.	I am encouraged to visit patients pre-operatively					
34.	I have the opportunity for on the job learning					
35.	My consultants have established good rapport with me					
36.	I am encouraged to participate in the theatre setting					
37.	There is a systematic clinical training programme					
38.	I feel able to ask the questions I want					
39.	Much of what I learn seems relevant to my career					
40.	I feel comfortable in theatre socially					
41.	There is racial discrimination in this post					

Thank you for taking the time to complete the questionnaire

Section 5 Annexures

5.1 Ethics approval



R14/49 Dr SA Khan; Profs L Green-Thompson & J Scribante

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL) CLEARANCE CERTIFICATE NO. M181049

NAME: Dr SA Khan; Profs L Green-Thompson & J Scribante
(Principal Investigator)
DEPARTMENT: School of Clinical Medicine
Department of Anaesthesiology
Chris Hani Baragwanath Academic Hospital

PROJECT TITLE: Evaluation of the anaesthetic theatre educational environment at the University of the Witwatersrand

DATE CONSIDERED: 26/10/2018

DECISION: Approved unconditionally

CONDITIONS:

SUPERVISOR: Ms H Perrie

APPROVED BY: 
Dr CB Penny, Chairperson, HREC (Medical)

DATE OF APPROVAL: 14/12/2018

This clearance certificate is valid for 5 years from date of approval. Extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Research Office Secretary on 3rd floor, Phillip V Tobias Building, Parktown, University of the Witwatersrand, Johannesburg.
I/We fully understand the conditions under which I am/we are authorised to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated from the research protocol as approved, I/we undertake to resubmit to the Committee. I agree to submit a yearly progress report. When a funder requires annual re-certification, the application date will be one year after the date of the meeting when the study was initially reviewed. In this case, the study was initially reviewed in October and will therefore reports and re-certification will be due early in the month of October each year. Unreported changes to the application may invalidate the clearance given by the HREC (Medical).

Principal Investigator Signature

Date

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

5.2 Graduate studies approval

UNIVERSITY OF THE
WITWATERSRAND
JOHANNESBURG



Private Bag 3 Wits, 2050
Fax: 027117172119
Tel: 02711 7172076

Reference: Mrs Sandra Benn
E-mail: sandra.benn@wits.ac.za

06 November 2018
Person No: 0702480Y
TAA

Dr SA Khan
P O Box 927
2630
South Africa

Dear Dr Saad Khan

Master of Medicine in Anaesthesia: Change of title of research

I am pleased to inform you that the following change in the title of your Research Report for the degree of **Master of Medicine in Anaesthesia** has been approved:

From:

To: **Evaluation of the anaesthetic theatre educational environment at the University of the Witwatersrand**

Yours sincerely

A handwritten signature in black ink, appearing to read 'S Benn'.

Mrs Sandra Benn
Faculty Registrar
Faculty of Health Sciences

5.3 Turnitin report

a0026657:Turnit_in_submission.docx

ORIGINALITY REPORT

5%

SIMILARITY INDEX

6%

INTERNET SOURCES

6%

PUBLICATIONS

9%

STUDENT PAPERS

PRIMARY SOURCES

1

Submitted to Aga Khan University

Student Paper

1%

2

www.apicareonline.com

Internet Source

1%

3

M. C. Holt. "Development and validation of the Anaesthetic Theatre Educational Environment Measure (ATEEM)", Medical Teacher, 9/1/2004

Publication

1%

4

Submitted to University of Witwatersrand

Student Paper

1%

5

www.nvmo.nl

Internet Source

1%

6

www.researchsquare.com

Internet Source

1%

Exclude quotes ☐ On

Exclude bibliography ☐ On

Exclude matches ☐ < 1%