

## Assessment of the education environment of senior medical students at the University of the Free State, Bloemfontein, South Africa

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**Background.** The education environment (EE) of a medical school plays a critical role in the learning of its students. The learner, other learners, teachers and the physical environment (campus and hospitals) influence the EE. In addition to recommendations of the Health Professions Council of South Africa (HPCSA) to revise the clinical training platform, staff and senior medical students occasionally experienced the EE in the clinical departments to be challenging.

**Objective.** To assess the perceived EE in clinical departments at the University of the Free State, Bloemfontein, South Africa, among the 2012 fourth- and fifth-year medical students. Differences in perceived EE scores between different demographic groups were also assessed.

**Method.** Only the departments where students rotated in both their fourth and fifth years (Obstetrics and Gynaecology, General Surgery, Paediatrics and Neonatology, Internal Medicine, and Psychiatry) were assessed. The Dundee Ready Education Environment Measure (DREEM) questionnaire was contextualised for each department and distributed among fourth- and fifth-year medical students. Questionnaires were self-administered and participation was voluntary. Differences among demographic groups and departments were assessed using the Mann-Whitney *U*-test and Kruskal-Wallis test ( $p < 0.05$ ).

**Results.** The overall response rate was 87.7%. The overall median DREEM combined score for the departments was 137/200. Paediatrics and Neonatology was consistently top-rated, whereas Obstetrics and Gynaecology consistently received the lowest rating in all domains and subscale analyses. There were few significant differences between the DREEM scores of demographic groups.

**Conclusion.** The overall EE in the clinical departments was mostly positive, although concerns were raised regarding some departments.

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Students' perceptions of their education environment (EE) have an undeniable impact on their study behaviour and academic progress.<sup>[1]</sup> If the EE of a medical school is positively perceived, it not only promotes intellectual activities, but also cultivates friendliness, co-operation, academic advancement and a sense of well-being.<sup>[2]</sup> Therefore, the acknowledgement of the EE as a significant confounding factor for effective student learning and success<sup>[2]</sup> is fast becoming established.<sup>[3]</sup> In a medical school, the EE can be conceptualised as a social system comprising the learner, individuals who interact with the learner, intention of the interaction, setting in which the learner interacts with other individuals, and formal and informal rules that govern the interaction.<sup>[4]</sup> Clapham *et al.*<sup>[5]</sup> described the EE as consisting of the following three major components: (i) the physical environment; (ii) the emotional climate; and (iii) the intellectual climate. Factors such as the increasingly diverse student population in medical programmes and curricula innovation have triggered a heightened interest in evaluating the EE of medical schools.<sup>[6]</sup>

In 2010, the Health Professions Council of South Africa (HPCSA) visited the University of the Free State (UFS), Bloemfontein, South Africa (SA), to re-accredit their medical programme. In contrast to the other seven medical schools in SA, which offer a six-year programme, the MB ChB degree at UFS comprises a five-year academic programme in three phases:<sup>[7]</sup>

Phase I: Six months of six introductory modules.

Phase II: Two preclinical years of basic medical science modules to establish the foundation for the clinical years.

Phase III: Two-and-a-half clinical years during which the students apply their knowledge gained in Phases I and II to learn clinical medicine in the different clinical departments.

In their report, the HPCSA accreditation panel raised concerns relating to the teaching platform at one of the training hospitals.<sup>[8]</sup> These concerns provoked further questions relating to the interaction of issues raised by the HPCSA and the perceived EE where students rotate during their clinical years (Phase III). Despite anecdotal feedback through informal conversations and quarterly discussions between the students' class representatives and the MB ChB programme director, the EE, as perceived by Phase III medical students, has never been formally assessed on a departmental level. Therefore, our objective was to assess the perceived EE in the clinical departments among the fourth- and fifth-year UFS medical students. Differences in perceived EE scores between different demographic groups were also assessed.

### Methods

The study was approved by the Ethics Committee of the Faculty of Health Sciences of the UFS (ECUFS 21/2012).

### Participants

The target population was all fourth- and fifth-year UFS medical students in 2012 ( $n=124$  and  $n=105$ , respectively). Those repeating their final year were excluded, as they did not rotate through all the departments involved

in the study. There were 111 male and 118 female students, of whom 105 and 124 received instruction and teaching in English and Afrikaans, respectively. Because of the UFS racial incident in 2008,<sup>[9]</sup> the students were asked to report their race to establish whether perceptions of racial discrimination existed in the EE of each department, yielding responses from 143 white and 86 black students.

## Data collection

The Dundee Ready Education Environment Measure (DREEM) was used because of its suitability in health sciences education<sup>[11]</sup> and reliability for measuring the EE in undergraduate medical education settings.<sup>[6]</sup> The DREEM questionnaire is self-administered, and consists of 50 items scored on a Likert scale to derive a total score out of 200.<sup>[11]</sup> Five subscales assess the perceived EE relating to the students' perceptions of teaching and learning (SPTL), the students' perceptions of the teachers (SPT), the students' academic self-perceptions (SASP), the students' perceptions of the atmosphere (SPA), and the students' social self-perceptions (SSSP).<sup>[11]</sup> Each of the 50 items was contextualised by inserting the names of the relevant department in each statement, e.g. 'I find the experience at General Surgery disappointing'. Five separate DREEM questionnaires were administered for the departments of Internal Medicine, Obstetrics and Gynaecology, Paediatrics and Neonatology, Surgery and Psychiatry (Appendix 1). These departments were chosen because they hosted both the fourth- and fifth-year cohorts and the rotations through these departments add up to 81% and 75% of the total clinical rotation time of the fourth and fifth years, respectively.<sup>[7]</sup> Departments not hosting both the fourth- and fifth-year students were excluded to minimise recall bias and ensure that the reports on the perceived EE were current at the time of data collection.

A pilot study was conducted using a group of three Afrikaans- and three English-speaking junior doctors who graduated from the UFS in the preceding academic year. To improve clarity and avoid ambiguity, minor contextual suggestions were incorporated into the questionnaire. To minimise the possible effect of translation errors, the DREEM questionnaire was administered in English only. The pilot study confirmed that the English language used in the DREEM questionnaire is basic enough for Afrikaans students to comprehend.

Data were collected during meetings with the students, where the questionnaires were distributed and returned on completion. By completing the questionnaire, consent was given

to participate in this study. Of a potential 1 145 questionnaires over the five departments, 1 037 were returned, of which 1 004 were complete and therefore valid for inclusion in the data analysis. The response rate ranged from 86% to 89% (mean 87.7%) across the five departments.

## Data analysis

Completed questionnaires were analysed with Microsoft Excel and SPSS version 20.

The Shapiro-Wilk test was used to test for normality and results were summarised using medians and percentiles. DREEM was calculated as a combined overall score across the five departments, and as individual scores for each department and each subset in each department. The Mann-Whitney *U*-test and Kruskal-Wallis test ( $p < 0.05$ ) were used to explore differences among demographic groups and departments.

**Table 1. Reliability statistics on the DREEM questionnaire data**

Completed DREEM questionnaires (per department – all students)	<i>n</i>	Cronbach's $\alpha$	Standard error of measurement (/200)
Internal Medicine	204	0.95	5.8
Obstetrics and Gynaecology	196	0.94	6.6
Paediatrics	202	0.93	5.0
Psychiatry	199	0.94	5.8
General Surgery	203	0.94	5.8
Total	1 004	0.96	6.2

DREEM = Dundee Ready Education Environment Measure.

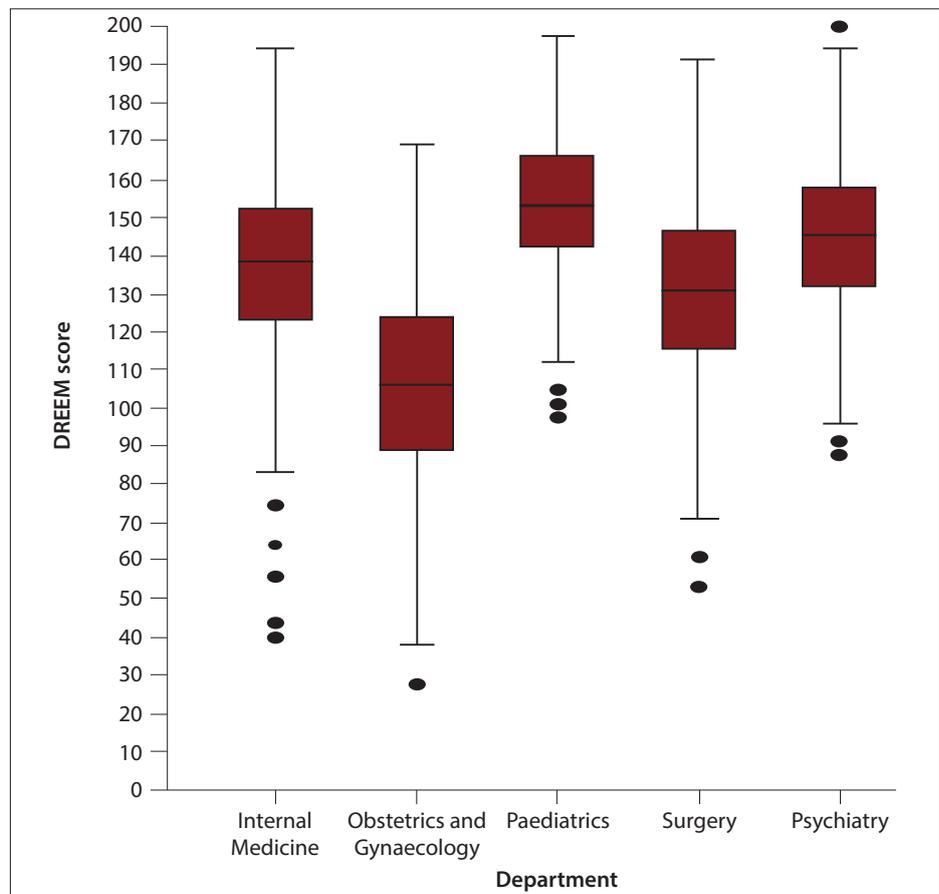


Fig. 1. Overall DREEM scores for the departments. The dots represent outliers falling outside 1.5 times the interquartile ranges of the DREEM distributions (DREEM = Dundee Ready Education Environment Measure).

## Results

The reliability analyses of the contextualised DREEM questionnaires are reported in Table 1.

The overall median DREEM score across all departments, with the demographic variables included, was 137 (Fig. 1). This equates to a 'more positive than negative' interpretation according to the published interpretation guidelines for the DREEM questionnaire.<sup>[11]</sup>

The students generally scored the perceived EE in Paediatrics and Neonatology the highest, with an overall median DREEM score of 153, while the department of Obstetrics and Gynaecology scored the lowest overall median DREEM score (106) (Fig. 1). Internal Medicine had a median DREEM score of 139, Surgery 131 and Psychiatry 145 (Fig. 1). When compared, all the departmental distributions were statistically different ( $p < 0.01$ ). The perceived EE was similar for males and females across all departments.

**Students' perceptions of teaching and learning (SPTL).** The median scores for this subscale ranged from 62% to 75%, equating to the top half of 'A more positive approach' (50 - 75%) result bracket.<sup>[11]</sup> Statistically significant differences in the SPTL distributions were noted when comparing individual departments ( $p < 0.01$ ), except between Psychiatry and Internal Medicine ( $p = 0.054$ ) and General Surgery and Psychiatry ( $p = 0.169$ ) (Table 2).

**Students' perceptions of teachers (SPT).** Four departments scored between 66% and 82%. This equates to a very positive result, ranging from 'Moving in the right direction' (51 - 75%) to 'Model teachers' (76 - 100%).<sup>[11]</sup> The only outlier of concern was noted in the Department of Obstetrics and Gynaecology, which scored significantly lower than the other four departments, with a median score of 51% and hinging on 'In need of some retraining' (26 - 50%).<sup>[11]</sup> Apart from this finding, statistically significant differences in the SPT distributions were noted in all departments ( $p < 0.01$ ), except between Internal Medicine and Psychiatry ( $p = 0.302$ ) (Table 2).

**Students' academic self-perceptions (SASP).** Scores ranged from 63% to 75%, equating to the top half of 'Feeling more on the positive' (51 - 75%) result bracket.<sup>[11]</sup> The departments of Paediatrics and Neonatology and Psychiatry scored equally. Besides this subscale being scored very positively overall, there were statistically significant differences in the SASP distributions among all departments ( $p < 0.05$ ), except between Paediatrics and Neonatology and Psychiatry ( $p = 0.119$ ) (Table 2).

**Students' perceptions of atmosphere (SPA).** All the departments scored in a range of 67 -

77%, except Obstetrics and Gynaecology, which received a disquieting score of 48%. This equates to four departments falling between the top half of 'A more positive atmosphere' (51 - 75%) to 'A good feeling overall' (76 - 100%) result brackets.<sup>[11]</sup> However, Obstetrics and Gynaecology was an outlier, falling in the disquieting 'There are many issues that need changing' result bracket.<sup>[11]</sup> Furthermore, there were statistically significant differences in the SPA distributions among all departments ( $p < 0.001$ ), except between Psychiatry and Paediatrics and

Neonatology ( $p = 0.207$ ) and General Surgery and Internal Medicine ( $p = 0.463$ ) (Table 2).

**Students' social self-perception (SSSP).** In this subscale, the scores for four departments ranged from 58% to 71%, except for Obstetrics and Gynaecology, which was an outlier (42%). This equates to four departments falling in the 'Not too bad' (51 - 75%) result bracket.<sup>[11]</sup> However, Obstetrics and Gynaecology fell into the disquieting 'Not a nice place' result bracket.<sup>[11]</sup> Similar to the SPA subscale, there were statistically significant differences in the SSSP distributions among all departments ( $p < 0.001$ ),

**Table 2. Median percentage subscale results per domain and department**

Department	SPTL, %	SPT, %	SASP, %	SPA, %	SSSP, %
Internal Medicine	71 <sup>*</sup>	73 <sup>*</sup>	72	67 <sup>*</sup>	63 <sup>*</sup>
Obstetrics and Gynaecology	62	51 <sup>†</sup>	63	48 <sup>†</sup>	42 <sup>†</sup>
Paediatrics and Neonatology	75	82 <sup>‡</sup>	75 <sup>*</sup>	77 <sup>*‡</sup>	71 <sup>*‡</sup>
General Surgery	67 <sup>*</sup>	66	69	69 <sup>*</sup>	58 <sup>*</sup>
Psychiatry	69 <sup>*</sup>	73 <sup>*</sup>	75 <sup>*</sup>	75 <sup>*</sup>	71 <sup>*</sup>

SPTL = students' perceptions of teaching and learning; SPT = students' perceptions of teachers; SASP = students' academic self-perceptions; SPA = students' perceptions of atmosphere; SSSP = students' social self-perception.

<sup>\*</sup>No statistical difference found in the subscale distribution analyses between individual departments.

<sup>†</sup>Disquieting results.

<sup>‡</sup>Excellent results.

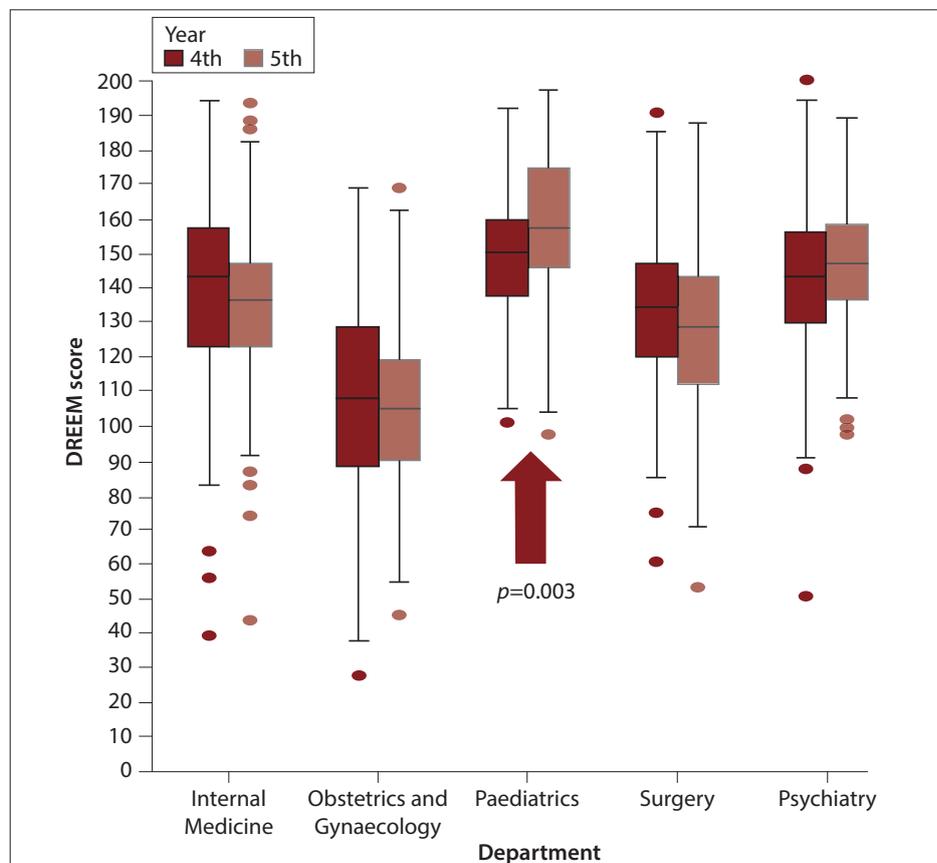


Fig. 2. DREEM scores of different year groups for the departments. The dots represent outliers falling outside 1.5 times the interquartile ranges of the DREEM distributions (DREEM = Dundee Ready Education Environment Measure).

except between Psychiatry and Paediatrics and Neonatology ( $p=0.112$ ) and General Surgery and Internal Medicine ( $p=0.51$ ) (Table 2).

Both the fourth and fifth years scored an overall median DREEM of 137 across all departments. Paediatrics and Neonatology attained the highest median DREEM scores for both the fourth (150) and fifth (159) years (Fig. 2). Obstetrics and Gynaecology achieved the lowest median scores for both the fourth (108) and fifth (105) years. The fifth-year students scored the perceived EE in the Department of Paediatrics and Neonatology significantly higher ( $p=0.003$ ) than the fourth-year students (Fig. 2). In all the other departments the DREEM distributions of the fourth- and fifth-year students were the same.

The students who received instruction and teaching in English scored the perceived EE in Internal Medicine significantly higher ( $p=0.004$ ; median = 145) than those who received instruction and teaching in Afrikaans (median = 135) (Fig. 3). In the Department of General Surgery, the Afrikaans cohort scored the perceived EE higher ( $p<0.001$ ; median = 137) compared with the English cohort (median = 124), while the perceived EEs were similar for both the English and Afrikaans cohorts in the other departments (Fig. 3).

The younger students (20 - 24 age group) rated General Surgery significantly higher ( $p=0.042$ ; median = 131) than the older students (>25 years group) (median = 127) (Fig. 4). However, there was no statistically significant difference noted in the EE rating in any of the four other departments (Fig. 4).

At Internal Medicine, the black students rated the EE higher ( $p<0.001$ ; median = 149) than the white students (median = 132) (Fig. 5). Similarly, at Obstetrics and Gynaecology, the black students rated the EE higher ( $p<0.001$ ; median = 114) than the white students (median = 101). However, at General Surgery the opposite occurred, as the white students rated the EE higher ( $p<0.001$ ; median = 135) than the black students (median = 120) (Fig. 5). There was no statistically significant difference noted in the other two departments.

## Discussion

The overall DREEM score for the five clinical departments was 137. This value falls in the same range (101 - 150) as that in some other studies, such as Brown *et al.*<sup>[12]</sup> (137.3), Riquelme *et al.*<sup>[13]</sup> (127.5) and Demirören *et al.*<sup>[14]</sup> (117.63). This range means a 'more positive than negative' result.<sup>[11]</sup> It is, however, important to note that the DREEM interpretation brackets are rather wide

(50 points) and a score of 101 or 149 has a similar interpretation, which is not ideal. Therefore, in our study the overall median DREEM score of 137 is actually firmly in the top half of its DREEM interpretation bracket and could possibly quite safely be interpreted as a 'much more positive than negative' EE. Interestingly, in general, both the fourth- and fifth-year medical students perceived the EE similarly, with a median DREEM of 137 for each year group. From the reliability analyses (Table 1) it was clear that the contextualised DREEM questionnaires were extremely reliable (Cronbach's  $\alpha > 0.9$  for all departments, together with a low standard error of mean (<7 DREEM marks)).<sup>[15]</sup> These findings also support the validity of the instrument used and compares favourably with the findings of other studies on Cronbach's  $\alpha$  of DREEM (0.93).<sup>[16]</sup>

At departmental level, it was noted that the median DREEM scores for the departments

ranged between 106 and 153. Therefore, in each department the students perceived the EE as 'more positive than negative'.<sup>[11]</sup> Paediatrics and Neonatology achieved the highest DREEM score (153), which was in the 'excellent' range.<sup>[11]</sup> Obstetrics and Gynaecology, on the other hand, had the lowest DREEM score (106), yet it was within the 'more positive than negative range'.<sup>[11]</sup> Comparing this score with a DREEM score of 139 obtained in a study by Varma *et al.*,<sup>[17]</sup> which only looked at the EE of Obstetrics and Gynaecology at different training platforms, it can be seen that in both studies the EE was perceived as 'more positive than negative',<sup>[11]</sup> but it is disquieting that the UFS Department of Obstetrics and Gynaecology's score was 33 points lower than that of the same department in the Varma *et al.*<sup>[17]</sup> study and 25 points lower than the fourth-ranked department in our study. The reasons for the difference are being further explored by UFS.

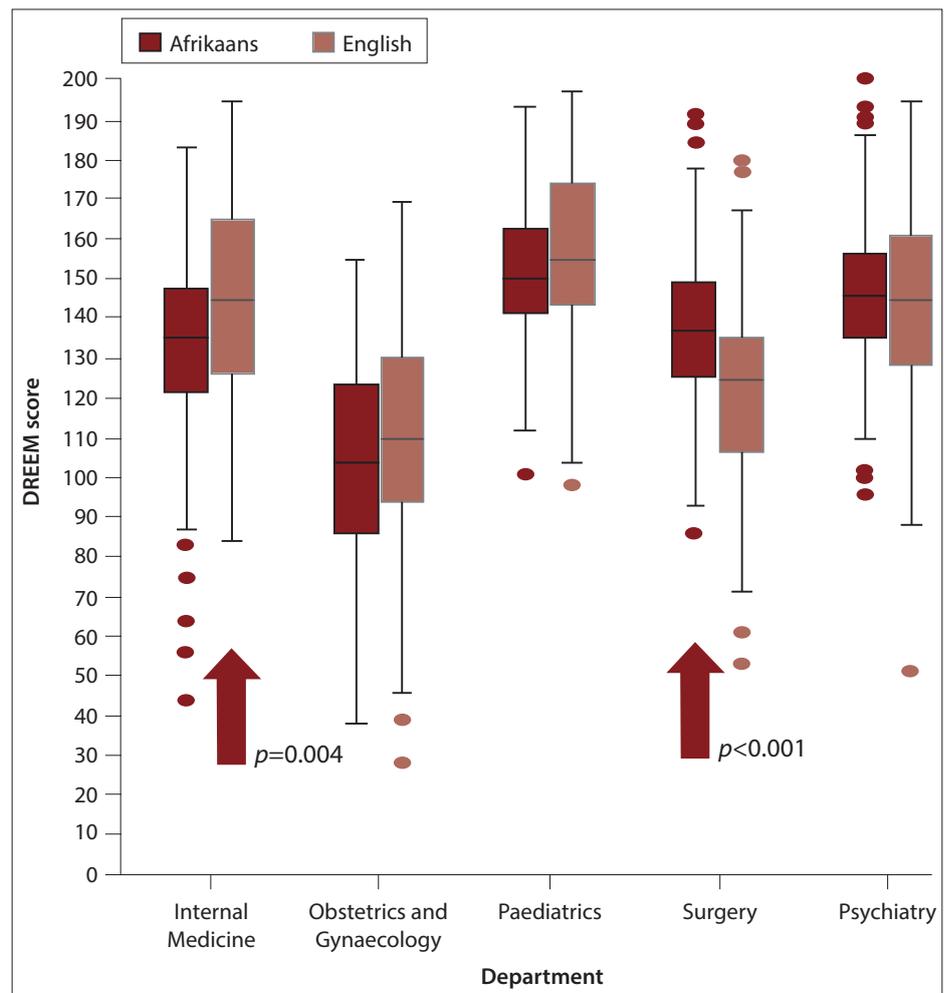


Fig. 3. DREEM scores of groups with different language of instruction for the departments. The dots represent outliers falling outside 1.5 times the interquartile ranges of the DREEM distributions (DREEM = Dundee Ready Education Environment Measure).

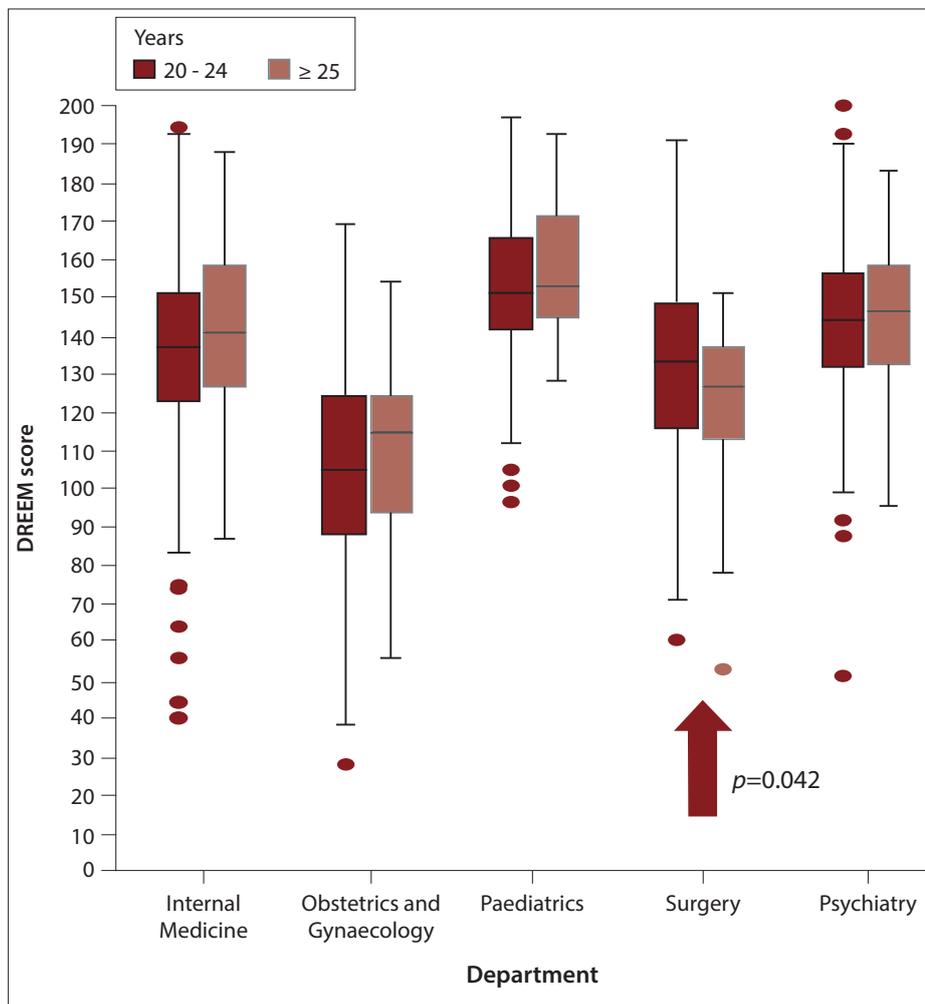


Fig. 4. DREEM scores of different age groups for the departments. The dots represent outliers falling outside 1.5 times the interquartile ranges of the DREEM distributions (DREEM = Dundee Ready Education Environment Measure).

Across most departments, the subscale analysis revealed positive to very positive results. Paediatrics and Neonatology was notably the top-performing department and achieved excellent scores in 4/5 subscales.<sup>[11]</sup> However, in contrast, Obstetrics and Gynaecology received some disquieting ratings in 3/5 subscales,<sup>[11]</sup> which included SPT, SPA and SSSP.

Based on standard subscale interpretation,<sup>[11]</sup> students' perceptions of Internal Medicine, Psychiatry and General Surgery were that teaching was helpful, relevant and useful and the teachers were moving in the right direction. The students were positive regarding their academic success and experienced the overall educational atmosphere as 'more positive'. The SSSP, while rotating at these three departments, was positively rated.

Based on the standard interpretation of subscales,<sup>[11]</sup> students at Obstetrics and Gynaecology indicated that teaching was helpful,

relevant and useful and the teachers were bordering on the need for some retraining (in terms of influencing the EE). The students felt more positive regarding their academic success but thought that there was much that needed changing with regard to the education atmosphere. The SSSP was that it was 'not a nice place'. It is therefore apparent that certain aspects of the EE at Obstetrics and Gynaecology are problematic and not conducive to the EE of the students.

Based on the standard interpretation of subscales,<sup>[11]</sup> students at Paediatrics and Neonatology indicated that teaching was helpful, relevant and useful and the teachers were excellent. The students felt confident regarding their academic success and the overall educational atmosphere was very positive. The SSSP was not too bad (positive).

Across all departments, fourth- and fifth-year students ranked the EE as 'more positive than negative',<sup>[11]</sup> with overall median DREEM scores

of 137 for each year group. This was similar to that found in a UFS study (L M Moja, H Louw, G Joubert – unpublished data, 2007). These authors used the DREEM questionnaire to measure the EE of the entire Faculty of Health Sciences at UFS. From that study it was reported that the fourth- and fifth-year medical students had overall median DREEM scores of 125 and 125, respectively. This fell in the same DREEM result bracket as the current study, with the EE of the clinical years of the School of Medicine being 'more positive than negative'.<sup>[11]</sup> Our study did however show an improvement of 12 points in the perceived EE in both year groups.

Overall, the language of instruction made little impact on the EE perceptions of the students. The only statistically significant effect was at General Surgery, where the students in the Afrikaans classes ranked the EE higher than those in the English classes, and at Internal Medicine, where the students in the English classes ranked the EE higher than those in the Afrikaans classes.

Interestingly, gender differences had no influence on how students perceived the EE in any of the clinical departments, which is a very positive finding.

Generally, the age of the students made very little impact on their perceptions of the EE. The only statistically significant effect was noted at General Surgery, where the younger age group ranked the EE higher than the older age group.

The race of the students made a significant impact on their EE perceptions in a majority (3/5) of the departments. These were Internal Medicine and Obstetrics and Gynaecology, where black students rated the EE higher than white students, compared with General Surgery, where white students rated the EE higher than black students.

In conclusion, the majority of clinical departments included in this study should be encouraged to continue with their good work to foster the positive EE for senior medical students. Furthermore, feedback regarding the outcome of this study was given to the medical school and the relevant departments and positive steps have been initiated to conduct further research (individual DREEM item analysis and some focus group discussions) into the areas where improvement in the EE is needed.

Limitations of this study included the following:

- Only five clinical departments were included. It would have been useful to have included all the departments in phase III of the curriculum.
- Only fourth- and fifth-year students participated in the study. It would have been useful to have

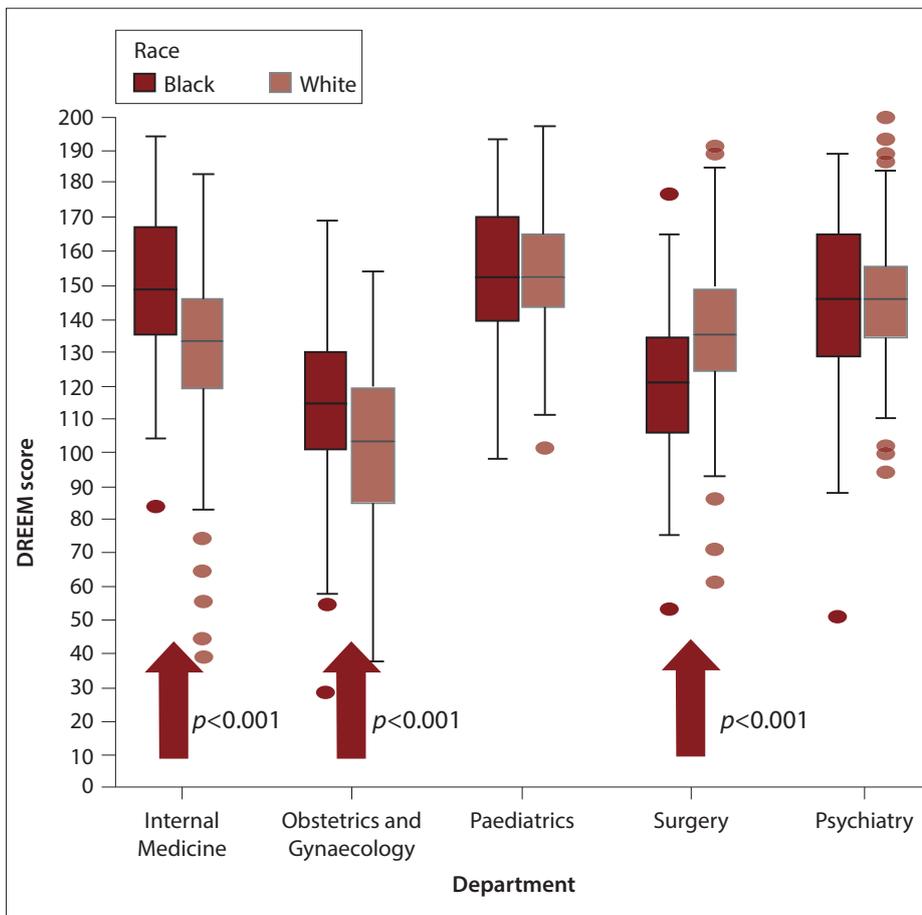


Fig. 5. DREEM scores of different races for the departments. The dots represent outliers falling outside 1.5 times the interquartile ranges of the DREEM distributions (DREEM = Dundee Ready Education Environment Measure).

included students in Semester 6 (third year), as they are part of phase III of the curriculum.

However, due to limited time and resources, the scope of the study had to be restricted.

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### Appendix 1. Contextualised Dundee Ready Education Environment Measure (DREEM) questionnaire, School of Medicine, University of the Free State, Bloemfontein, South Africa: The education environment perceptions of senior medical students at the Department of Internal Medicine (example)

Statements	Strongly agree (4)	Agree (3)	Unsure (2)	Disagree (1)	Strongly disagree (0)
1. I am encouraged to participate in Internal Medicine lectures					
2. The lecturers in Internal Medicine are knowledgeable					
3. There is a good support system in Internal Medicine for students who become stressed					
4. I am too tired to enjoy Internal Medicine					
5. Learning strategies which worked for me before continue to work for me now at Internal Medicine					
6. The teachers at Internal Medicine are patient with patients					
7. The teaching at Internal Medicine is often stimulating					
8. The teachers at Internal Medicine ridicule (humiliate) the students (Afrikaans = verkleineer)					

continued...

**Appendix 1 (continued). Contextualised Dundee Ready Education Environment Measure (DREEM) questionnaire, School of Medicine, University of the Free State, Bloemfontein, South Africa: The education environment perceptions of senior medical students at the Department of Internal Medicine (example)**

Statements	Strongly agree (4)	Agree (3)	Unsure (2)	Disagree (1)	Strongly disagree (0)
9. The teachers at Internal Medicine are authoritarian (bossy)					
10. I am confident about passing Internal Medicine					
11. The atmosphere at Internal Medicine is relaxed during ward teaching					
12. Internal Medicine is well time-tabled					
13. The teaching at Internal Medicine is student-centred					
14. I am rarely bored at Internal Medicine					
15. I have good friends who rotate with me at Internal Medicine					
16. The teaching at Internal Medicine helps to develop my competence					
17. Cheating is a problem at Internal Medicine					
18. The Internal Medicine teachers have good communication skills with patients					
19. My social life is good while rotating at Internal Medicine					
20. The teaching at Internal Medicine is well-focused					
21. I feel Internal Medicine is preparing me well for my profession					
22. The teaching at Internal Medicine helps to develop my confidence					
23. The atmosphere is relaxed during Internal Medicine lectures					
24. The teaching time at Internal Medicine is put to good use					
25. The teaching at Internal Medicine over-emphasises factual learning					
26. Last year's work has been a good preparation for this year's work in Internal Medicine					
27. I am able to memorise all I need to in Internal Medicine					
28. I seldom feel lonely at Internal Medicine					
29. The teachers at Internal Medicine are good at providing feedback to students					
30. There are opportunities for me to develop interpersonal skills at Internal Medicine					
31. Internal Medicine has taught me a lot about empathy in my profession					
32. The teachers at Internal Medicine provide constructive criticism					
33. I feel comfortable socially at Internal Medicine					
34. Internal Medicine seminars/tutorials have a relaxed atmosphere					
35. I find the experience at Internal Medicine disappointing					
36. I am able to concentrate well at Internal Medicine					
37. The Internal Medicine teachers give clear examples					
38. I am clear about the learning objectives at Internal Medicine					
39. The Internal Medicine teachers get angry during teaching sessions					
40. The Internal Medicine lecturers are well prepared					
41. My problem-solving skills are being well developed at Internal Medicine					
42. The enjoyment at Internal Medicine outweighs the stress					
43. The atmosphere at Internal Medicine motivates me as a learner					
44. The teaching at Internal Medicine encourages me to be an active learner					
45. Much of what I have to learn in Internal Medicine seems relevant to a career in medicine					
46. Overall, my rotation at Internal Medicine was pleasant					
47. Long-term learning at Internal Medicine is emphasised over short-term learning					
48. The teaching at Internal Medicine is too teacher-centred					
49. I feel able to ask the questions I want to at Internal Medicine					
50. The students irritate the Internal Medicine teachers					