

# Preclinical and Clinical Medical Students' Perception of the Learning Environment: A Reference to the Forensic Medicine and Clinical Toxicology Course

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**Purpose:** Understanding learning environments is vital for developing curricula. This study aims to evaluate medical students' achievements and perception of learning environments considering the Forensic Medicine and Clinical Toxicology course as an analog for the curricular transition process.

**Methods:** A cross-sectional study was conducted among undergraduate medical students at the Faculty of Medicine, Tanta University, from August 2020 to October 2021. Using the Dundee Ready Education Environment Measure (DREEM) questionnaire, the perception of 621 students (of which 307 were enrolled in the integrated curriculum and 314 in the traditional curriculum) were compared. Furthermore, the appropriate tests of significance and correlations were used to compare students' perception according to their enrollment, age, gender, and previous year grade point average.

**Results:** The mean overall DREEM score was  $121.04 \pm 22.35$ , implying a more positive than negative learning environment, that is, a more positive learning perception, with students' perceptions of teachers moving in the right direction, students' academic self-perceptions getting more on the positive side, more positive attitudes regarding student's perceptions of the learning environment, and not-too-bad student's social self-perception. Medical students enrolled in the integrated curriculum showed higher DREEM scores, with significantly better learning and academic self-perceptions ( $p < 0.05$ ). Knowledgeable, qualified faculties are the most significant characteristic feature in both systems. A significant number of students achieved excellent grades in the integrated curriculum ( $n = 740$  out of 1076, 68.8%) than in the traditional one ( $n = 470$  out of 961, 48.9%) ( $p < 0.0001$ ).

**Conclusion:** This study revealed a smooth, successful transition from the traditional to integrated curriculum among Egyptian medical students. The main areas for improvements are focusing on factual teaching, implementing student-centered teaching activities, promoting students' memorizing, and engaging students in activities that may help them enjoy learning.

**Keywords:** learning, education, self-perception, achievement, curriculum, competency-based education

## Introduction

Learning environment is a collective term that covers every aspect related to a specific educational program. It includes, but is not limited to, teaching strategies, course syllabi, assessment modalities, teaching faculties, and learning resources.<sup>1</sup> Students in different learning contexts are influenced by the various learning environments in terms of perception, understanding of learning practices, and achieving learning objectives and planned outcomes.<sup>2</sup>

Understanding the learning environment is vital for developing curricula. It helps in exploring a program's strengths that can be capitalize on and in outlining improvement areas for the purpose of reorganization. Questionnaires are among the appropriate methods proposed to explore the learning environment from student perspectives, which aid in optimizing different aspects of the learning context.<sup>3</sup>

The Dundee Ready Education Environment Measure (DREEM) questionnaire is one of the most valid and reliable recommended tools for assessing learning environments, especially among healthcare professions.<sup>4</sup> The DREEM

questionnaire assists in describing different learning domains, outlining problematic issues, and solving emerging problems to enhance a learning process's efficiency. It can be used to compare learning experiences in diverse settings with each other and with ideal ones proposed in similar settings.<sup>5</sup>

In Egypt, and up to recent years, most medical schools adopted the French model: a 6-year program followed by 1 year of internship. After completion, the graduate earns a Bachelor of Medicine and Surgery (MBBCH) degree. The French model deploys a traditional subject-based, teacher-centered curriculum where all students attend theoretical lectures as one batch and are only divided into subgroups for practical and clinical purposes. The gradual shift toward integrated curricula started in various medical schools in 2009, except for the Suez-Canal University, which started earlier than 2009.<sup>6</sup>

The Faculty of Medicine, Tanta University, was first established in 1962 and subsequently recognized by the World Directory of Medical Schools. In 2018, major curricular changes were deployed, and the curriculum for the Medicine and Surgery Bachelor Program (MSBP-CB) was changed to the integrated system-based credit point (282 credit hours) system. The MSBP-CB program is divided into three phases: Phase I (basic preparatory modules taught during first and second years), Phase II (preclinical modules taught during the third year), and Phase III (clinical courses taught during the fourth, fifth, and sixth years). Problem-based, student-centered educational approaches with early exposure to some clinical practices were the primary learning strategies that were adopted. Additionally, different levels of integration (vertical and horizontal) were adopted during the program's different phases.

In the traditional program, the Forensic Medicine and the Clinical Toxicology course is scheduled for the fourth-year students as a clinical course. In the integrated program, despite the clinical nature of the course, it is delivered to second-year students as a means of vertical integration.

Global studies were carried out to address medical students' perception toward the curricular reform. These studies were carried out in European countries like Sweden,<sup>7</sup> in the Middle East like Saudi Arabia and Kuwait and in other developing countries like Chile and Turkey.<sup>8–11</sup> To the best of our knowledge, although there is a simultaneous change toward the integrated curricula in Egyptian universities, no previous work had been conducted in Egypt that examines medical students' perception toward these changes in the different learning phases. Therefore, and because of the critical medicolegal importance of the Forensic Medicine and Clinical Toxicology course, our study aims to evaluate medical students' perception of learning environments wherein the course is delivered in two different learning contexts (traditional subject-based curriculum versus the integrated system-based curriculum). Moreover, this study aims to compare students' achievements in the MBBCH program—where the course is taught in clinical phases—with the integrated MSBP-CB program—where the same course is delivered in basic phases.

## Materials and Methods

### Study Design and Setting

This research is a cross-sectional study that was conducted among two cohorts of undergraduate medical students at the Faculty of Medicine, Tanta University, from August 2020 to October 2021.

### Sample Size

The total number of students enrolled in traditional and integrated systems was 2037 students (961 enrolled in the MBBCH program and 1076 enrolled in the MSBP-CB program). As the difference in perception of DREEM scale between the two systems was unknown, so considering occurrence equaled no occurrence=50% with a margin of error of 0.04, and confidence level 95%, the sample size has been calculated and it was 464 students. Accounting for a drop-out of 20%, the minimal sample size was estimated to be 557 students. The questionnaire was distributed to all students. Out of them, 715 consented to participate. However, 621 responses were included (distributed as 307 students in the MBBCH program and 314 students in the MSBP-CB program) after excluding incomplete responses with a response rate of 86.9% (621/715).

## Participants and Grouping

The study participants were divided into two groups according to their program enrollment. The first group comprised students enrolled in the MBBCH program (traditional curriculum, fourth-year students in the clinical phase), while the second group comprised those in the MSBP-CB program (integrated curriculum, second-year students in the basic phase). Both groups attended lectures on the same campus, and the same instructors provided the same learning material for both groups.

## Inclusion Criteria

Students who had completed the Forensic Medicine and Clinical Toxicology course were allowed to participate, provided that they were registered as regular students who successfully completed all previous courses.

## Exclusion Criteria

Students who had withdrawn from or were denied exam entry were excluded from the study, and those who did not complete previous years' modules before joining the course and those with incomplete questionnaires were also excluded.

## Ethical Considerations

Data collection commenced after the study was approved by the Research Ethical Committee of the Faculty of Medicine, Tanta University (number 34379/1/21). Following the recommendations of the 1964 Declaration of Helsinki and its subsequent amendments, the collected data and students' records were handled anonymously to maintain the confidentiality of the participants. Moreover, all participants gave their written informed consent before their inclusion in the study. The students were free to participate. Besides, a statement that clearly stated the study's objectives and procedures was added at the beginning of the questionnaire.

## Data Collection Tools and Instruments

### The DREEM Questionnaire

In the final weeks of the semester, after finalizing students' assessments, they were briefed regarding the contents of the questionnaire and how to fill it. Then, the online questionnaire was distributed as a link through email and paper-based questionnaires were provided to those without email access. Students were briefed on the items and read the questionnaire carefully before responding on a 5-point Likert scale, where responses ranged from *strongly agree* to *strongly disagree*. An English version of the questionnaire was adopted given that all students had passed the placement test for language before joining the Faculty of Medicine.

The DREEM questionnaire is a 50-item questionnaire distributed under 5 main domains: Student's Perceptions of Learning (SPL), Student's Perceptions of Teachers (SPT), Student's Academic Self-Perceptions (SAP), Student's Perceptions of Atmosphere (SPA), and Student's Social Self-Perception (SSP) as follows:<sup>8</sup>

- Domain 1: SPL [(items: 1, 7, 13, 16, 20, 22, 24, 25, 38, 44, 47, and 48) 12 items/max score 48].
- Domain 2: SPT [(items: 2, 6, 8, 9, 18, 29, 32, 37, 39, 40, and 50) 11 items/max score 44].
- Domain 3: SAP [(items: 5, 10, 21, 26, 27, 31, 41, and 45) 8 items/max score 32].
- Domain 4: SPA [(Items: 11, 12, 17, 23, 30, 33, 34, 35, 36, 42, 43, and 49) 12 items/max score 48].
- Domain 5: SSP [Items: 3, 4, 14, 15, 19, 28, and 46) 7 items/max score 28].

### Scoring of the DREEM Questionnaire

All items were scored as follows: 4 for strongly agree, 3 for agree, 2 for uncertain, 1 for disagree, and 0 for strongly disagree. Nine out of the fifty items (items 4, 8, 9, 17, 25, 35, 39, 48, and 50) were scored in negatively: 0 for strongly agree, 1 for agree, 2 for uncertain, 3 for disagree, and 4 for strongly disagree. The overall scoring was interpreted according to McAleer and Roff,<sup>9</sup> as follows:

- 0–50: Very poor;
- 51–100: Plenty of problems;
- 101–150: More positive than negative; and
- 151–200: Excellent.

Additionally, each domain was analyzed, and each item's response was checked to ascertain if they were above 3 and 3.5, which is considered positive, while items scored less than 2 were considered problematic. Items scored between 2 and 3 required educational climate enhancement. After completing the DREEM questionnaire items, the respondents answered questions related to age, gender, and previous years' grade point averages (GPAs).

### Students' Achievements

The achievements of all students registered in both programs, regardless of their participation in our study, were obtained from the Assessment and Evaluation Center of the Faculty of Medicine, Tanta University. These achievements include the results of summative assessments and the average of formative assessments for every student. Results were categorized as excellent (85–100%), very good (70–84%), good (55–69%), fair (40–54%), fail (<40%), and absent. This grading system is adopted by Tanta University, Faculty of Medicine, and is aligned with General Egyptian Universities Guidelines which might vary between different Egyptian schools and even in the same Faculty running two different programs. Brief modifications were conducted to compare the studied groups using a unified scale.<sup>10</sup>

### Rigor

To ensure robustness of the current study, A pilot study was carried out before starting data collection including 40 participants of the target population with the following objectives: 1. to test and evaluate the adequacy of the questionnaire, 2. to estimate the time needed for filling the questionnaire and 3. to determine the potential obstacles that might be met with during execution of the study. Pilot study was carried out using online and paper-based questionnaires.

Feedback of pilot study revealed that no questions have to be added, deleted or rephrased so the tool was adopted as it is. Moreover, the time needed for filling the questionnaire ranged from 15–20 minutes.

To assess reliability, the study tool was tested by the pilot subjects at first session and the calculated Cronbach's Alpha was 0.831. Moreover, the internal consistency reliability was calculated using Spearman-Brown Prophecy formula ( $r_1 = 2(r) / (1+r)$ ) where  $r$  estimated correlation coefficient computed on the split halves and  $r_1$  estimated reliability of the entire test and it was 0.814.<sup>11</sup> The results of the pilot were included in the final results as there were no changes or modifications done to the tool of the study.

### Statistical Data Analysis

Data were analyzed using SPSS version 27 (SPSS Inc., Chicago, IL, USA). Quantitative data were presented as mean  $\pm$  SD, and qualitative data were presented as frequencies and percentages. The chi-square test and Fischer's exact test were used to assess associations between qualitative variables, while the Mann-Whitney  $U$ -test and the Kruskal-Wallis  $H$ -test were conducted to compare the DREEM scores among the different groups. Spearman correlation was used for investigating correlation between the DREEM score and its subscales among the studied groups. A  $Z$ -score test was used to compare students' achievements in the two groups. The level of significance was considered to be  $P < 0.05$ .

### Results

The DREEM questionnaire was distributed to 2037 medical students (961 enrolled in the MBBCH program and 1076 in the MSBP-CB program). Overall, females ( $n = 319$ , 51.4%) slightly outnumbered males ( $n = 302$ , 48.6%). However, for those enrolled in the traditional program, males slightly outnumbered females (52.1% and 47.9%, respectively). The age of the included participants ranged from 19 to 24 years, with a mean age of  $21.71 \pm 5.12$  years. Significant variations of the enrolled students in terms of age were noticed, as 97.1% of those enrolled in traditional programs were aged 20 years and above, while 98.4% of students enrolled in the integrated curriculum were aged less than 20 years. Table 1 presents previous years' GPAs, with no significant variations between the study groups.

**Table 1** Demographic and Educational Profiles of the Respondents Who Participated in the Current Study

Age/Gender and Previous Year GPA	Traditional MBBCH System (n=307)		Integrated MSBP-CB System (n=314)		Total (n=621)		Test of Significance	p value
	n	%	n	%	n	%		
<b>Age:</b>							$\chi^2 = 566.342$	0.000*
< 20 years	9	2.9	309	98.4	318	51.2		
≥20 years	298	97.1	5	1.6	303	48.8		
<b>Gender:</b>							$\chi^2 = 2.954$	0.086
Male	160	52.1	142	45.2	302	48.6		
Female	147	47.9	172	54.8	319	51.4		
<b>Previous year GPA</b>							$\chi^2 = 1.781$	0.776
Excellent	143	46.6	141	44.9	284	45.7		
Very good	95	30.9	96	30.6	191	30.8		
Good	54	17.6	66	21.0	120	19.3		
Fair	10	3.3	7	2.2	17	2.7		
Fail	5	1.6	4	1.3	9	1.4		

**Notes:**  $\chi^2$ , chi square test. \*Significant at <0.05.

**Abbreviations:** GPA, Grade Point Average; n, number.

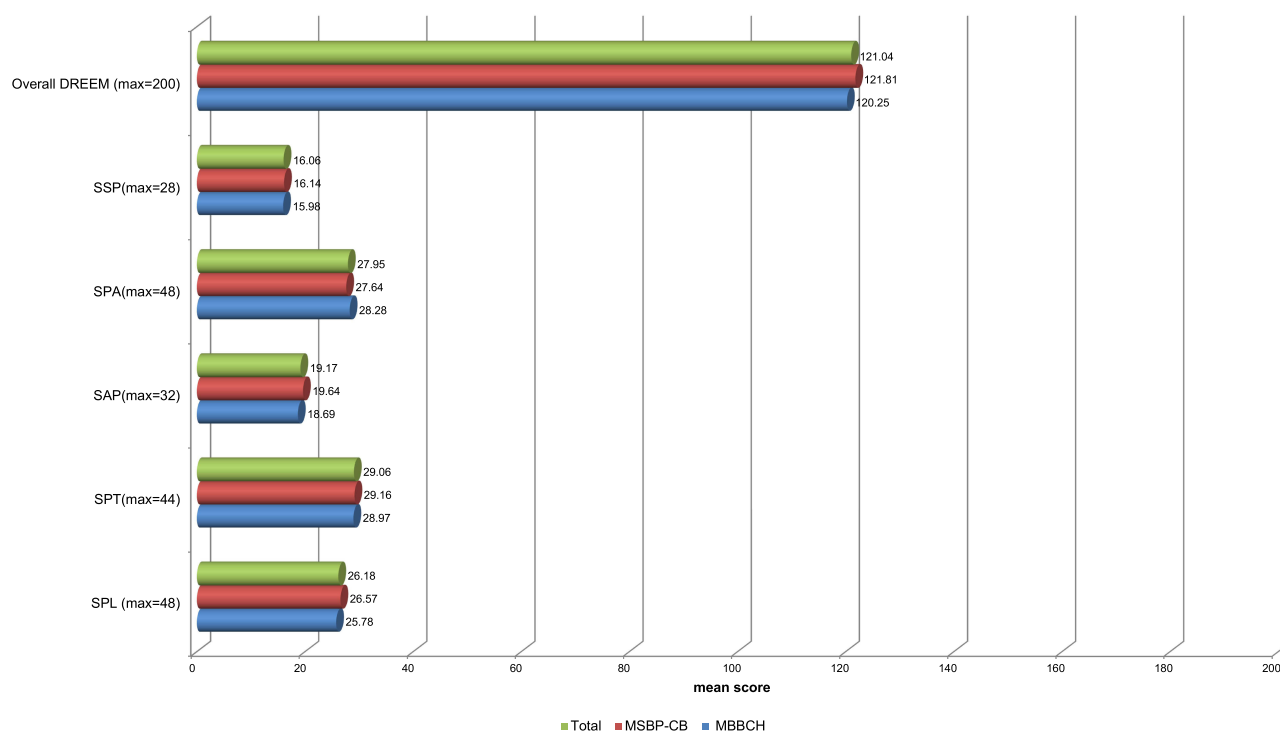
As depicted in Table 2 and Figure 1, this study revealed a mean overall DREEM score of  $121.04 \pm 22.35$  among the study participants, implying a more positive than negative learning environment and no difference the type of the program. Regarding DREEM subscales, this study conveys a more positive learning perception, with SPT moving in the right direction, SAPs being more on the positive side, there being more positive attitudes regarding student's perceptions of the learning environment, and not-too-bad students' SSP. Students enrolled in the integrated program showed significantly higher means of learning perception and academic self-perceptions ( $p < 0.05$ ) compared to those enrolled in the traditional program. Table 3 presents the interpretation of the DREEM questionnaire and its subscales in both study groups; as can be seen, there were no significant variations.

**Table 2** Comparison Between the Traditional MBBCH and Integrated MSBP-CB Systems Regarding Mean Total DREEM and Its Subscales' Scores

Total DREEM and its Subscales	Interpretation	Traditional MBBCH System	Integrated MSBP-CB System	Total	Z Score of Mann Whitney U-test	p value
		Mean $\pm$ SD	Mean $\pm$ SD	Mean $\pm$ SD		
SPL (maximum=48)	A more positive perception	25.78 $\pm$ 4.84	26.57 $\pm$ 5.02	26.18 $\pm$ 4.94	-2.588	0.010*
SPT (maximum=44)	Moving in the right direction	28.97 $\pm$ 5.53	29.16 $\pm$ 5.97	29.06 $\pm$ 5.75	-0.754	0.451
SAP (maximum=32)	Feeling more on the positive side	18.69 $\pm$ 4.82	19.64 $\pm$ 4.82	19.17 $\pm$ 4.84	-2.648	0.008*
SPA (maximum=48)	A more positive attitude	28.28 $\pm$ 6.63	27.64 $\pm$ 7.11	27.95 $\pm$ 6.87	-0.546	0.585
SSP (maximum=28)	Not too bad	15.98 $\pm$ 3.41	16.14 $\pm$ 3.26	16.06 $\pm$ 3.33	-0.386	0.699
Overall DREEM (maximum=200)	More Positive than Negative	120.25 $\pm$ 21.78	121.81 $\pm$ 22.91	121.04 $\pm$ 22.35	-1.400	0.161

**Note:** \*Significant at <0.05.

**Abbreviations:** SD, standard deviation; DREEM, Dundee Ready Education Environment Measure; SPL, student's perceptions of learning; SPT, student's perceptions of teachers; SAP, student's academic self-perceptions; SPA, student's perceptions of atmosphere; SSP, student's social self-perception.



**Figure 1** Comparing the traditional MBBCH and the integrated MSBP-CB systems regarding mean total DREEM and its subscale scores.

Examining DREEM subscales on discrete bases yielded valuable findings, as shown in Table 4 and Figure 2. Regarding students' perceptions of learning, a significant number of students enrolled in the integrated program perceived teaching as more simulating (2.68) than those enrolled in the traditional program (2.51) ( $p = 0.025$ ). Similarly, a significant number of students enrolled in the integrated program perceived the teaching as less teacher centered compared to those in the traditional program ( $p = 0.002$ ). Conversely, a significant number of students enrolled in the traditional program showed a better perception of the teaching time as put to good use than integrated program students ( $p = 0.001$ ).

Concerning students' perception of teachers, those in the integrated program showed significantly higher mean scores for the item "the teachers get angry in the class" (2.43) than those in the traditional program group (2.21). Significantly better perceptions among students in the integrated program compared to those enrolled in the traditional program were noticed in the academic self-perception and students' SSP domains. This includes higher mean values of the perception of learning strategies that continue to work, previous years' proper preparation for the current year, good support systems for stressed students, and making good friends inside the school ( $p < 0.05$ ). Similarly, the students in the integrated program perceived the learning environment as less disappointing compared to those in the traditional system (mean = 2.23 versus 1.83, respectively). Paradoxically, other items were significantly better perceived by students enrolled in the traditional program compared to those enrolled in the integrated one, which includes a proper timetable and a relaxing atmosphere during lectures ( $p < 0.05$ ).

Table 5 presents the variations between male and female students' perceptions of the learning environment in both programs. The overall DREEM scores were higher for females than males; however, the difference was not statistically significant. The mean overall mean DREEM was ( $122.7 \pm 20.4$ ) for females and ( $119.3 \pm 24.1$ ) for males. Among the DREEM subscales, females had higher scores than males enrolled in the same program in all subscales, except for SSP where male had higher mean scores in both groups. However, gender variations were statistically significant ( $p < 0.05$ ) only in the perceptions of teachers' domain. Figure 3 highlights these variations.

Considering the study participants' age, our study found nonsignificant differences in the overall DREEM scores between the two groups ( $p > 0.05$ ). However, and as Figure 4 illustrates, younger students aged less than 20 years showed

**Table 3** Level of Scores of the DREEM Inventory and Its Subscales Among Participants Enrolled in Both Systems and Recruited in the Current Study

Level of Score Based on Domains	Traditional MBBCH System (n=307) n (%)	Integrated MSBP-CB System (n=314) n (%)	Total (n=621) n (%)	Test of Significance	p value
<b>Total DREEM</b>					
Very poor	2 (0.7%)	2 (0.6%)	4 (0.6%)	$\chi^2 = 2.054$	0.561
Plenty of Problems	40 (13.0%)	52 (16.6%)	92 (14.8%)		
More Positive than Negative	247 (80.5%)	238 (75.8%)	485 (78.1%)		
Excellent	18 (5.8%)	22 (7.0%)	40 (6.4%)		
<b>SPL</b>				FE=4.270	0.199
Very Poor	5 (1.6%)	4 (1.3%)	9 (1.5%)		
Teaching is viewed negatively	99 (32.2%)	79 (25.2%)	178 (28.7%)		
A more positive perception	202 (65.8%)	229 (73.2%)	431 (69.5%)		
Teaching highly thought of	1 (0.3%)	1 (0.3%)	2 (0.3%)		
<b>SPT</b>				$\chi^2 = 0.757$	0.860
Abysmal	2 (0.7%)	2 (0.6%)	4 (0.6%)		
In need of some retraining	29 (9.4%)	34 (10.8%)	63 (10.1%)		
Moving in the right direction	215 (70.0%)	210 (66.9%)	425 (68.4%)		
Model teachers	61 (19.9%)	68 (21.7%)	129 (20.8%)		
<b>SAP</b>				$\chi^2 = 4.042$	0.275
Feelings of total failure	8 (2.6%)	5 (1.6%)	13 (2.1%)		
Many negative aspects	87 (28.3%)	74 (23.6%)	161 (25.9%)		
Feeling more on the positive side	183 (59.6%)	194 (61.8%)	377 (60.7%)		
Confident	29 (9.4%)	41 (13.1%)	70 (11.3%)		
<b>SPA</b>				$\chi^2 = 3.385$	0.280
A terrible environment	5 (1.6%)	10 (3.2%)	15 (2.4%)		
There are many issues which need changing	72 (23.5%)	88 (28.0%)	160 (25.8%)		
A more positive attitude	208 (67.8%)	198 (63.1%)	406 (65.4%)		
A good feeling overall	22 (7.2%)	18 (5.7%)	40 (6.4%)		
<b>SSP</b>				$\chi^2 = 0.742$	0.863
Miserable	5 (1.6%)	4 (1.3%)	9 (1.4%)		
Not a nice place	84 (27.4%)	91 (29.0%)	175 (28.2%)		
Not too bad	205 (66.8%)	209 (66.6%)	414 (66.7%)		
Very good socially	13 (4.2%)	10 (3.2%)	23 (3.7%)		

**Abbreviations:** N, number;  $\chi^2$ , chi square; FE, Fischer's exact test; DREEM, Dundee Ready Education Environment Measure; SPL, student's perceptions of learning; SPT, student's perceptions of teachers; SAP, student's academic self-perceptions; SPA, student's perceptions of atmosphere; SSP, student's social self-perception.

significantly higher SPL mean values ( $26.5 \pm 5.1$ ) compared to students aged 20 years and above ( $25.8 \pm 4.8$ ), ( $p = 0.012$ ). Conversely, students aged 20 years and above showed higher SPT mean values among those enrolled in the traditional program. Moreover, the mean SAP value was significantly higher in students aged less than 20 years ( $19.6 \pm 4.9$ ) than in older students ( $18.7 \pm 4.7$ ), ( $p < 0.05$ ), as shown in Table 6.

Table 7 and Figure 5 show the mean DREEM score and its subscales among participants according to their previous GPAs. Among them, students with higher GPAs (Excellent) showed significantly higher mean values in terms of overall DREEM, SPL, SPT, and SAP scores ( $p < 0.05$ ). A similar finding had been obtained among students enrolled in the traditional curriculum, where students with higher GPAs (Excellent) showed significantly higher mean values in terms of overall DREEM, SPL, and SPT scores ( $p < 0.05$ ). The variations in the overall DREEM scores (including those of its

**Table 4** Comparison Between the Traditional MBBCH and Integrated MSBP-CB Systems Regarding the Mean Item Scores

Subscale	Item	Mean Item Score			Z Score of Mann Whitney U-test	p value
		Traditional MBBCH System	Integrated MSBP-CB System	Total		
SPL	1. I am encouraged to participate in class	2.87	2.93	2.90	-0.299	0.765
	7. The teaching is often stimulating	2.51	2.68	2.60	-2.238	0.025*
	13. The teaching is student-centred	2.45	2.53	2.49	-1.087	0.277
	16. The teaching helps to develop my competence	2.56	2.68	2.62	-1.806	0.071
	20. The teaching is well focused	2.67	2.68	2.68	-0.141	0.888
	22. The teaching helps to develop my confidence	2.43	2.52	2.48	-1.200	0.230
	24. The teaching time is put to good use	2.55	2.29	2.42	-3.173	0.002*
	25. The teaching over emphasizes factual learning #	1.45	1.60	1.53	-1.645	0.100
	38. I am clear about the learning objectives of the course	2.60	2.67	2.63	-1.394	0.163
	44. The teaching encourages me to be an active learner	2.44	2.46	2.45	-0.552	0.581
SPT	47. Long-term learning is emphasized over short-term learning	2.30	2.43	2.37	-1.684	0.092
	48. The teaching is too teacher-centered #	1.50	1.75	1.63	-3.180	0.001*
	2. The teachers are knowledgeable	3.28	3.21	3.24	-1.298	0.194
	6. The teachers are patient with students	2.79	2.86	2.83	-0.817	0.414
	8. The teachers ridicule the students #	2.86	2.97	2.92	-1.279	0.201
	9. The teachers are authoritarian #	2.63	2.75	2.69	-1.217	0.224
	18. The teachers have good communication skills with patients	2.78	2.75	2.76	-0.208	0.825
	29. The teachers are good at providing feedback to students	2.64	2.53	2.58	-1.275	0.202
	32. The teachers provide constructive criticism here	2.34	2.40	2.37	-0.799	0.424
	37. The teachers give clear examples	2.70	2.68	2.69	-0.210	0.833
SAP	39. The teachers get angry in the class #	2.21	2.43	2.32	-2.491	0.013*
	40. The teachers are well prepared for their classes	2.71	2.71	2.71	-0.037	0.971
	50. The students irritate the teachers #	2.03	1.88	1.95	-1.841	0.066
	5. Learning strategies which worked for me before continue to work for me now	2.39	2.59	2.49	-2.862	0.004*
	10. I am confident about passing this year	2.84	2.89	2.86	-0.374	0.709
	21. I feel I am being well prepared for my profession	2.17	2.24	2.21	-0.716	0.474
	26. Last year's work has been a good preparation for this year's work	2.24	2.50	2.37	-3.198	0.001*
	27. I am able to memorize all I need	1.93	1.93	1.93	-0.099	0.921
31. I have learned a lot about empathy in my profession	2.44	2.57	2.50	-1.716	0.086	
41. My problem-solving skills are being well developed here	2.27	2.39	2.33	-1.268	0.205	
45. Much of what I have to learn seems relevant to a career in healthcare	2.41	2.54	2.48	-1.612	0.107	

(Continued)



**Table 4** (Continued).

Subscale	Item	Mean Item Score			Z Score of Mann Whitney U-test	p value
		Traditional MBBCH System	Integrated MSBP-CB System	Total		
SPA	11. The atmosphere is relaxed during the ward teaching	2.48	2.42	2.45	-0.368	0.713
	12. This school is well timetabled	2.53	2.11	2.32	-4.301	0.000*
	17. Cheating is a problem in this course #	2.00	1.88	1.94	-1.488	0.137
	23. The atmosphere is relaxed during lectures	2.68	2.47	2.57	-2.503	0.012*
	30. There are opportunities for me to develop interpersonal skills	2.26	2.36	2.31	-1.388	0.165
	33. I feel comfortable in class socially	2.52	2.45	2.48	-0.814	0.416
	34. The atmosphere is relaxed during seminars/ tutorials	2.55	2.53	2.54	-0.245	0.807
	35. I find the experience disappointing #	1.83	2.23	2.03	-4.721	0.000*
	36. I am able to concentrate well	2.34	2.40	2.37	-1.278	0.201
	42. The enjoyment outweighs the stress of the course	2.14	2.12	2.13	-0.291	0.771
SSP	43. The atmosphere motivates me as a learner	2.35	2.20	2.27	-1.305	0.192
	49. I feel able to ask the questions I want	2.60	2.46	2.53	-0.966	0.334
	3. There is a good support system for students who get stressed	2.33	2.48	2.41	-2.294	0.022*
	4. I am too tired to enjoy this course #	1.58	1.63	1.61	-0.635	0.526
	14. I am rarely bored on this school	2.20	2.06	2.13	-1.482	0.138
	15. I have good friends in this school	2.83	3.09	2.96	-3.112	0.002*
	19. My social life is good	2.46	2.33	2.40	-1.449	0.147
28. I seldom feel lonely	2.18	2.07	2.12	-1.230	0.219	
46. My accommodation is pleasant	2.41	2.46	2.44	-1.028	0.304	

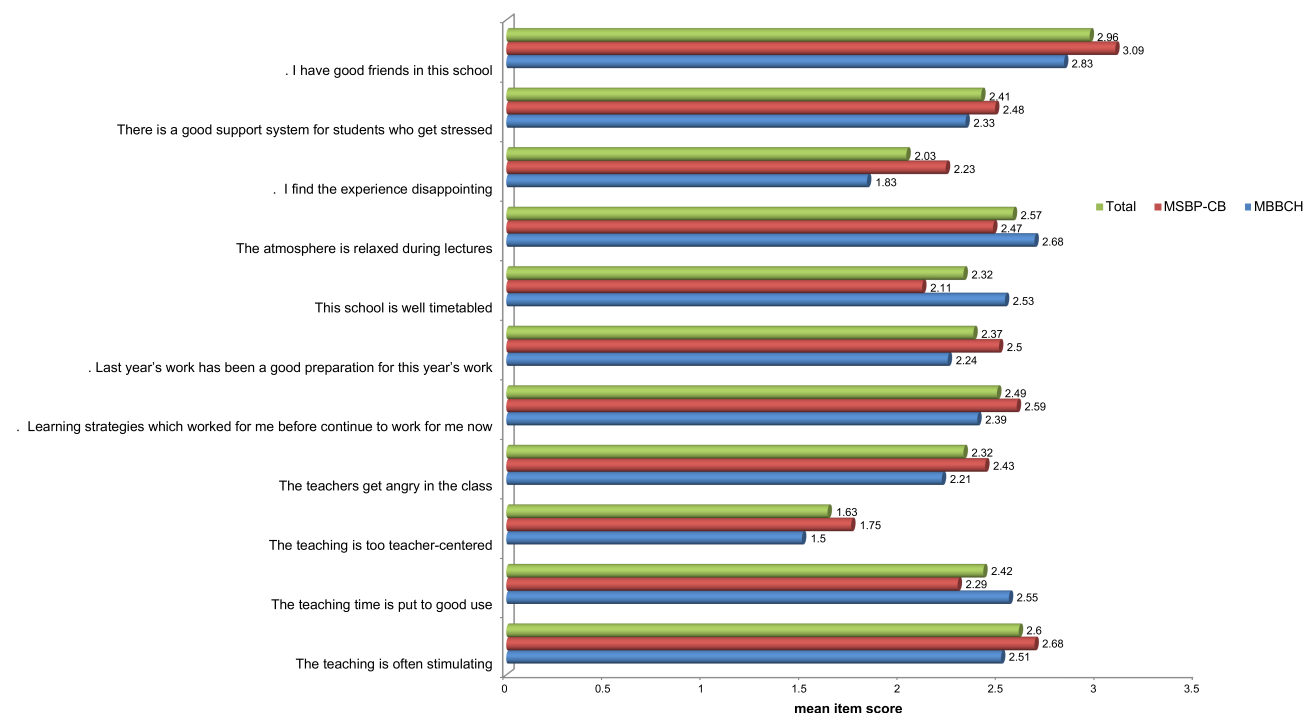
Notes: #Negative statements; \*Significant at <0.05.

Abbreviations: FE, Fischer's exact test; DREEM, Dundee Ready Education Environment Measure; SPL, student's perceptions of learning; SPT, student's perceptions of teachers; SAP, student's academic self-perceptions; SPA, student's perceptions of atmosphere; SSP, student's social self-perception.

subscales) between students enrolled in the integrated curriculum were not statistically significant. Table 8 shows a significant positive correlation between Overall DREEM, SPL, SPT, SAP, SPA and the previous year GPA among students enrolled in the traditional program. Moreover, there was a significant negative correlation between SPL, SAP and students age among all studied participants.

Table 9 summarizes the areas of weakness and strength between the study groups. Four areas were problematic in both groups: teaching over-emphasizes factual learning, teaching is too teacher centered, I am able to memorize all that I need, and I am too tired to enjoy this course. In the integrated curriculum, two additive items were considered weak areas, including "the students irritate the teachers" and "cheating is a problem in this course." However, the student's perception of the atmosphere in a traditional program needs improvement, especially in their evaluation of their learning experience as disappointing. We could not find any items ranked >3.5. However, the highest-ranked item was the students' perception of teachers, where the mean of the response to the item "the teachers are knowledgeable" was 3.24 out of 4. Centralization of the teaching and feeling disappointing were significantly more reported among students enrolled in traditional program. Table 10 shows moderate to strong positive correlation between Overall DREEM, and its subscales among all students and among every group according to the program of enrollment ( $p < 0.001$ ).

Regarding students' performances in both programs, our study revealed a significant finding. As Table 11 and Figure 6 show, a significant number of students in the integrated curriculum achieved excellent grades ( $n = 740$  out of



**Figure 2** Items that differed significantly between the traditional MBBCH and the integrated MSBP-CB systems in terms of mean item scores.

1076, 68.8%) compared to those in the traditional program ( $n = 470$  out of 961, 48.9%), ( $p < 0.0001$ ). Comparable proportions of students (25.5% for the traditional program versus 23.7% for the integrated one) got “Very Good” with no significant variations between the study groups ( $p = 0.4009$ ). However, a significant number of students scored “Good,” “Fair,” “Fail,” and “Absent” among those enrolled in the traditional program, a with  $p$  values of  $<0.001$ .

## Discussion

This study was conducted to evaluate medical students’ achievements and perceptions of learning environments in traditional and integrated curricula considering the Forensic Medicine and Clinical Toxicology course as an analog for the reformed learning context. Although the transition from a traditional to an integrated curriculum is a worldwide phenomenon that has been implemented for years in different medical colleges, such a transition should be carefully considered in terms of perceived and associated benefits and deficiencies (for students and faculties).

This study analyzed the achievements of 2037 students and the responses of 621 medical students, a relatively high number compared to previous studies, as highlighted in Table 12. The number of females in this study was greater than that of males; however, the difference was not statistically significant. As illustrated in Table 12, several previous studies revealed different patterns of male and female students’ distribution, reflecting gender distribution variations among different populations. Conversely, the reported significant variations in age distribution between the study participants in both groups are a reflection of the time schedule of running programs. Students enrolled in the integrated curriculum were younger (year two) than those in the traditional program (year four).

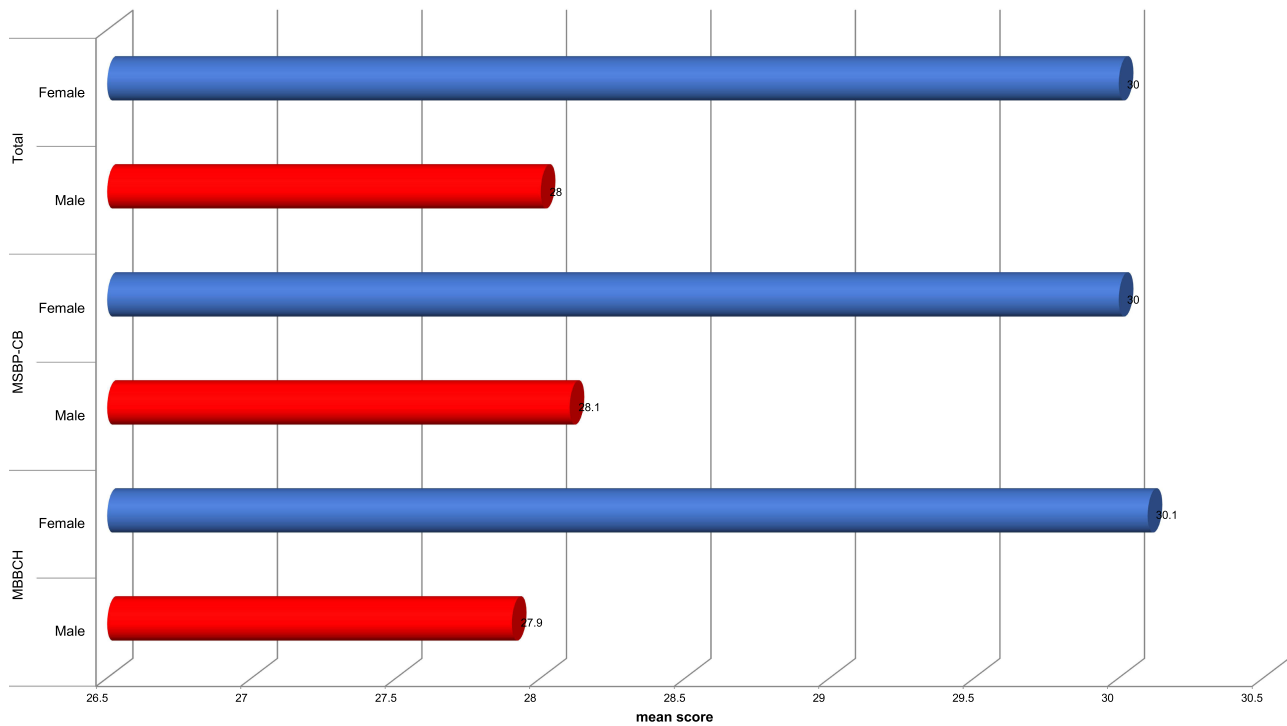
This study conveyed more positive than negative learning environments, with slightly higher overall DREEM scores for students in the integrated program than those in the traditional program (121.81 and 120.25, respectively). The reported overall score was similar to scores of students in the School of Medical Sciences, University Sains, Malaysia, enrolled in preclinical, paraclinical, and clinical years (128.36, 122.27, and 125.49, respectively).<sup>12</sup> Medical students enrolled in traditional systems in different learning contexts showed similar or even much lower scores than those in our study.<sup>13–15</sup> Conversely, students enrolled in hybrid or integrated student-centered curricula exhibited significantly higher scores.<sup>13,16,17</sup> The significant improvement in students’ perceptions of the learning environment following curricular

**Table 5** Mean Score of DREEM Inventory and Its Subscales Based on Gender in Both Study Groups

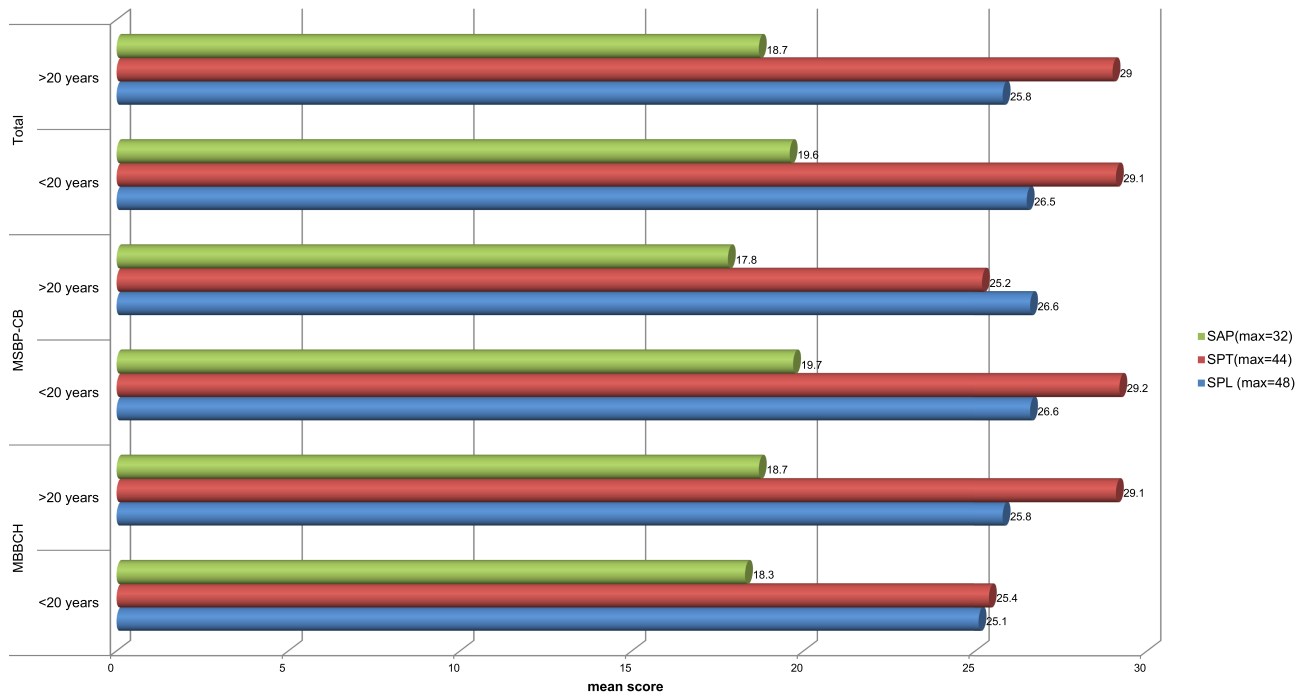
Total DREEM and its Subscales	Traditional MBBCH System		Integrated MSBP-CB System		Total	
	Male	Female	Male	Female	Male	Female
<b>SPL (max=48)</b> Mean ± SD	25.1 ± 5.4	26.5 ± 4.0	26.4 ± 5.3	26.7 ± 4.8	25.7 ± 5.4	26.6 ± 4.4
Z score of Mann Whitney U-test	-1.862		-0.619		-1.841	
p value	0.063		0.536		0.066	
<b>SPT (max=44)</b> Mean ± SD	27.9 ± 5.6	30.1 ± 5.3	28.1 ± 6.2	30.0 ± 5.6	28.0 ± 5.9	30.0 ± 5.4
Z score of Mann Whitney U-test	-3.155		-2.809		-4.255	
p value	0.002*		0.005*		0.000*	
<b>SAP (max=32)</b> Mean ± SD	18.6 ± 5.2	18.8 ± 4.4	19.6 ± 5.3	19.7 ± 4.4	19.1 ± 5.2	19.3 ± 4.4
Z score of Mann Whitney U-test	-0.457		-0.003		-0.115	
p value	0.647		0.998		0.909	
<b>SPA (max=48)</b> Mean ± SD	27.6 ± 7.0	29.0 ± 6.1	27.5 ± 7.8	27.8 ± 6.5	27.5 ± 7.4	28.4 ± 6.3
Z score of Mann Whitney U-test	-1.272		-0.378		-1.103	
p value	0.203		0.706		0.270	
<b>SSP (max=28)</b> Mean ± SD	16.2 ± 3.6	15.8 ± 3.2	16.4 ± 3.2	15.9 ± 3.3	16.3 ± 3.4	15.8 ± 3.2
Z score of Mann Whitney U-test	-1.326		-0.664		-1.401	
p value	0.185		0.506		0.161	
<b>Overall DREEM (max=200)</b> Mean ± SD	118.0 ± 23.4	122.7 ± 19.7	120.7 ± 24.9	122.8 ± 21.1	119.3 ± 24.1	122.7 ± 20.4
Z score of Mann Whitney U-test	-1.298		-0.869		-1.684	
p value	0.194		0.385		0.092	

**Note:** \*Significant at <0.05.

**Abbreviations:** DREEM, Dundee Ready Education Environment Measure; SPL, student's perceptions of learning; SPT, student's perceptions of teachers; SAP, student's academic self-perceptions; SPA, student's perceptions of atmosphere; SSP, student's social self-perception.



**Figure 3** Comparing the traditional MBBCH and the integrated MSBP-CB systems regarding the mean student's perceptions of teacher (SPT) score based on gender.



**Figure 4** Comparing the traditional MBBCH and the integrated MSBP-CB systems regarding the mean scores of SAP, SPT, and SPL based on age.

reforms is not incidental and is related to the root causes that impel most medical schools to reform their curricula to be integrated, student-centered, problem-based, and socially accountable.<sup>18</sup>

However, when moving more in-depth, our study yielded significant variations between students' perceptions of different score subscales in both study groups. Students enrolled in the integrated curriculum showed significantly better

**Table 6** Mean Score of DREEM Inventory and Its Subscales Based on Age in Both Study Groups

Total DREEM and its Subscales	Traditional MBBCH System		Integrated MSBP-CB System		Total	
	<20 Years	≥20 Years	<20 Years	≥20 Years	<20 Years	≥20 Years
<b>SPL (max=48)</b> Mean ± SD	25.1 ± 7.1	25.8 ± 4.7	26.6 ± 5.0	26.6 ± 6.2	26.5 ± 5.1	25.8 ± 4.8
Z score of Mann Whitney U-test	-0.151		-0.465		-2.525	
p value	0.880		0.642		0.012*	
<b>SPT (max=44)</b> Mean ± SD	25.4 ± 6.0	29.1 ± 5.5	29.2 ± 5.9	25.2 ± 9.6	29.1 ± 5.9	29.0 ± 5.6
Z score of Mann Whitney U-test	-1.976		-1.383		-0.527	
p value	0.048*		0.167		0.598	
<b>SAP (max=32)</b> Mean ± SD	18.3 ± 8.6	18.7 ± 4.7	19.7 ± 4.8	17.8 ± 5.9	19.6 ± 4.9	18.7 ± 4.7
Z score of Mann Whitney U-test	-0.136		-0.807		-2.738	
p value	0.892		0.420		0.006*	
<b>SPA (max=48)</b> Mean ± SD	28.6 ± 7.5	28.3 ± 6.6	27.7 ± 7.1	25.2 ± 8.2	27.7 ± 7.1	28.2 ± 6.6
Z score of Mann Whitney U-test	-0.267		-0.721		-0.331	
p value	0.789		0.471		0.741	
<b>SSP (max=28)</b> Mean ± SD	17.0 ± 5.5	16.0 ± 3.3	16.1 ± 3.3	16.4 ± 2.5	16.2 ± 3.3	16.0 ± 3.3
Z score of Mann Whitney U-test	-1.061		-0.110		-0.599	
p value	0.289		0.913		0.549	
<b>Overall DREEM (max=200)</b> Mean ± SD	116.8 ± 30.5	120.4 ± 21.5	121.9 ± 22.8	114.2 ± 25.8	121.8 ± 23.1	120.3 ± 21.6
Z score of Mann Whitney U-test	-0.137		-0.946		-1.485	
p value	0.862		0.344		0.138	

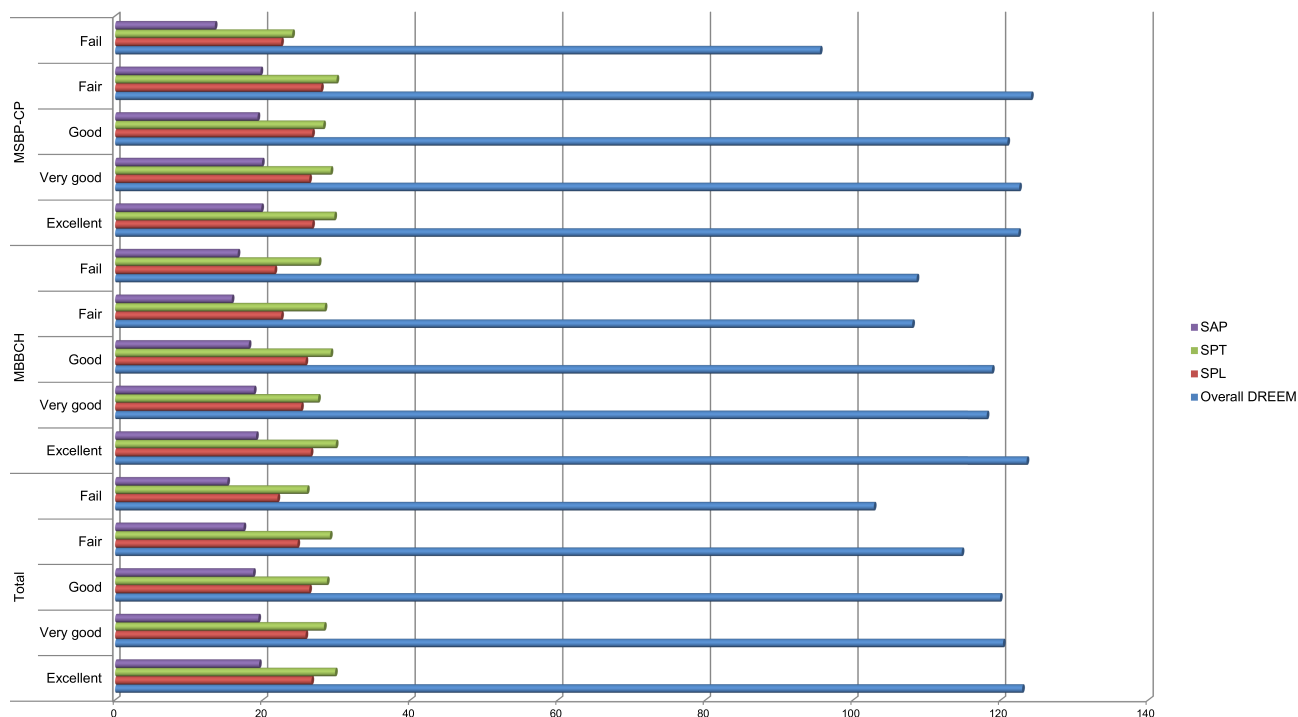
**Note:** \*Significant at <0.05.**Abbreviations:** DREEM, Dundee Ready Education Environment Measure; SPL, student's perceptions of learning; SPT, student's perceptions of teachers; SAP, student's academic self-perceptions; SPA, student's perceptions of atmosphere; SSP, student's social self perception.

**Table 7** Mean Score of DREEM Inventory and Its Subscales Based on the Previous Year's GPA in Both Study Groups

Studied Groups	Previous Year GPA	Overall DREEM (Max=200)	SPL (Max=48)	SPT (Max=44)	SAP (Max=32)	SPA (Max=48)	SSP (Max=28)
		Mean ± SD					
<b>Total</b>	Excellent	122.9 ± 24.0	26.6 ± 5.2	29.8 ± 6.0	19.5 ± 5.1	28.3 ± 7.3	16.2 ± 3.4
	Very good	120.3 ± 20.4	25.8 ± 4.7	28.3 ± 5.2	19.4 ± 4.5	28.1 ± 6.2	16.1 ± 3.3
	Good	119.9 ± 20.6	26.3 ± 4.4	28.7 ± 5.6	18.7 ± 4.6	27.6 ± 6.5	15.9 ± 3.1
	Fair	114.7 ± 24.8	24.7 ± 5.3	29.1 ± 7.3	17.4 ± 4.7	25.5 ± 8.6	15.8 ± 4.0
	Fail	102.8 ± 14.9	22.0 ± 4.4	26.0 ± 5.7	15.2 ± 3.3	23.4 ± 7.2	14.0 ± 2.3
	Kruskal Wallis <i>H</i> -test p value	14.133 0.007*	15.202 0.004*	11.661 0.020*	11.763 0.019*	7.344 0.119	5.446 0.244
<b>Traditional MBBCH system</b>	Excellent	123.5 ± 23.5	26.5 ± 5.2	29.9 ± 5.6	19.1 ± 5.2	29.1 ± 7.0	16.3 ± 3.5
	Very good	118.1 ± 19.0	25.2 ± 4.4	27.5 ± 5.0	18.8 ± 4.3	28.0 ± 5.8	15.9 ± 3.2
	Good	118.8 ± 20.4	25.8 ± 4.3	29.2 ± 5.2	18.1 ± 4.5	27.6 ± 6.6	15.5 ± 3.2
	Fair	108.0 ± 22.9	22.5 ± 4.3	28.4 ± 7.4	15.8 ± 4.3	23.3 ± 7.2	16.2 ± 4.8
	Fail	108.6 ± 15.1	21.6 ± 4.4	27.6 ± 4.3	16.6 ± 2.6	26.8 ± 5.7	13.8 ± 2.5
	Kruskal Wallis <i>H</i> -test p value	11.8333 0.019*	18.799 0.001*	12.021 0.017*	7.621 0.106	8.186 0.085	5.764 0.217
<b>Integrated MSBP-CB system</b>	Excellent	122.4 ± 24.5	26.7 ± 5.3	29.7 ± 6.4	19.8 ± 5.0	27.6 ± 7.5	16.1 ± 3.3
	Very good	122.5 ± 21.6	26.3 ± 4.9	29.2 ± 5.1	19.9 ± 4.6	28.1 ± 6.6	16.3 ± 3.4
	Good	120.9 ± 20.8	26.7 ± 4.5	28.2 ± 5.9	19.3 ± 4.6	27.6 ± 6.5	16.4 ± 2.9
	Fair	124.1 ± 25.8	27.9 ± 5.3	30.0 ± 7.5	19.7 ± 4.5	28.7 ± 9.9	15.3 ± 2.8
	Fail	95.5 ± 12.8	22.5 ± 4.9	24.0 ± 7.2	13.5 ± 3.7	19.3 ± 7.3	14.3 ± 2.4
	Kruskal Wallis <i>H</i> -test p value	6.481 0.166	3.897 0.420	4.875 0.300	6.811 0.146	5.110 0.276	3.775 0.437

**Note:** \*Significant at <0.05.

**Abbreviations:** GPA, grade point average; DREEM, Dundee Ready Education Environment Measure; SPL, student's perceptions of learning; SPT, student's perceptions of teachers; SAP, student's academic self-perceptions; SPA, student's perceptions of atmosphere; SSP, student's social self-perception.



**Figure 5** Comparing the traditional MBCH and the integrated MSBP-CB systems regarding the mean score of SAP, SPT, SPL, and overall DREEM based on the previous year's GPA.

perceptions of learning and better academic self-perceptions, as can be demonstrated by more stimulating teaching, less teacher-centered teaching, and less angry teachers in comparison with students of the traditional system. The fact regarding students' perceptions of learning and teaching being better because of integration is consistent with the results

**Table 8** Correlation Between Score of DREEM and Its Subscales, Age and Previous Year GPA in Both Studied Groups

Studied Groups	DREEM and its Subscale	Previous Year GPA		Age	
		r	P value	r	P value
Total	Total DREEM	0.115	0.004*	-0.057	0.157
	SPL	0.099	0.013*	-0.104	0.001*
	SPT	0.109	0.006*	-0.035	0.377
	SAP	0.09	0.019*	-0.101	0.011*
	SPA	0.079	0.048*	0.017	0.671
	SSP	0.044	0.271	-0.004	0.911
Traditional MBCH system	Total DREEM	0.179	0.002*	0.001	0.864
	SPL	0.194	0.001*	0.008	0.883
	SPT	0.125	0.029*	0.037	0.521
	SAP	0.128	0.025*	0.009	0.877
	SPA	0.130	0.023*	-0.004	0.943
	SSP	0.110	0.054	0.022	0.696
Integrated MSBP-CB system	Total DREEM	0.057	0.313	-0.051	0.386
	SPL	0.017	0.758	-0.081	0.154
	SPT	0.101	0.074	-0.100	0.078
	SAP	0.066	0.242	-0.050	0.374
	SPA	0.031	0.589	-0.007	0.905
	SSP	-0.020	0.722	0.027	0.638

**Notes:** r, Spearman rho correlation coefficient. \*Significant at <0.05.

**Abbreviations:** GPA, grade point average; DREEM, Dundee Ready Education Environment Measure; SPL, student's perceptions of learning; SPT, student's perceptions of teachers; SAP, student's academic self-perceptions; SPA, student's perceptions of atmosphere; SSP, student's social self-perception.

**Table 9** Positive Points and Problematic Areas in the Learning Environment as Illustrated by the Mean Item Scores

Subscale	Items	Mean Item Score			Z Score of Mann Whitney U-test	P value
		Traditional MBBCH System	Integrated MSBP-CB System	Total		
<b>SPL</b>	<b>Problematic areas or that need attention:</b> 25. The teaching over emphasizes factual learning	1.45	1.60	1.53	-1.645	0.100
	48. The teaching is too teacher-centered	1.50	1.75	1.63	-3.179	0.001*
<b>SPT</b>	50. The students irritate the teachers	2.03	1.88	1.95	-1.840	0.066
<b>SAP</b>	27. I am able to memorize all I need	1.93	1.93	1.93	-0.098	0.921
<b>SPA</b>	17. Cheating is a problem in this course	2.00	1.88	1.94	-1.488	0.137
	35. I find the experience disappointing	1.83	2.23	2.03	-4.720	0.000*
<b>SSP</b>	4. I am too tired to enjoy this course	1.58	1.63	1.61	-0.634	0.526
<b>SPT</b>	<b>Positive points **</b> 2. The teachers are knowledgeable	3.28	3.21	3.24	-1.298	0.194

**Notes:** \*Significant at <0.05, \*\*No items scored more than 3.5, however item 2 shows the highest rank.

**Abbreviations:** DREEM, Dundee Ready Education Environment Measure; SPL, student's perceptions of learning; SPT, student's perceptions of teachers; SAP, student's academic self-perceptions; SPA, student's perceptions of atmosphere; SSP, student's social self-perception.

of a previous study conducted in Saudi Arabia.<sup>13</sup> A higher perception of learning and teaching upon integration is an encouraging finding. The main goals of program integration are increasing dependence on self-learning and active participation and improving autonomy in thinking and reasoning. Traditional curricula that employ teacher-centered educational strategies typically depend on providing students with readymade opinions and judgments, which some scholars have described as spoon-feeding.<sup>13</sup>

Additionally, our study reveals some bright points in the form of significant improvements in students' perception of aspects related to academic self-perceptions following curriculum integration. Students enrolled in the integrated system described the previous learning strategies as continuing to work and the previous year's work as sufficient preparation for the current year's work had significantly higher scores than their peers in the traditional curriculum. This finding is consistent with those of Zawawi and Elzubeir, where the mean score of students' academic self-perception reported for the traditional curriculum was 13.95 compared to 19.81 for the reformed curriculum.<sup>13</sup> Similarly, another study reported that students in basic years exhibited better academic self-perception than those in paraclinical and clinical years (22.59, 19.64, and 20.68, respectively).<sup>12</sup> However, contrary to the current findings, in Kuwait, Bouhaimed et al reported a deterioration of academic self-perception during the transition from traditional to problem-based learning.<sup>19</sup> It is worth mentioning that the deterioration of the academic self-perception score after curricular changes among Kuwaiti students was primarily because of the poor perception of learning strategies and the students' belief that the previous year's work had no role in the preparation for the current year. These two items were the same that showed significant improvement among students enrolled in the integrated system in this study. This discrepancy could be related to the different nature of the transition between the two studies. In Egypt, students enrolled in the new curriculum were novices and had no previous experience with the traditional curriculum in contrast to Kuwaiti students, who were part of the traditional system before being involved in the reformed curriculum, which highlights the necessity of students' preparation before



**Table 10** Spearman Correlation Coefficients Between Score of DREEM and Its Subscales, Among Studied Groups

Studied Groups	DREEM and its Subscale	Total DREEM	SPL	SPT	SAP	SPA	SSP
		Spearman rho Correlation Coefficient					
Total	Total DREEM	1	0.846	0.733	0.863	0.895	0.713
	SPL		1	0.540	0.714	0.697	0.548
	SPT			1	0.480	0.570	0.361
	SAP				1	0.754	0.619
	SPA					1	0.584
	SSP						1
Traditional MBBCH system	Total DREEM	1	0.830	0.695	0.855	0.883	0.755
	SPL		1	0.493	0.649	0.688	0.582
	SPT			1	0.445	0.530	0.369
	SAP				1	0.727	0.666
	SPA					1	0.594
	SSP						1
Integrated MSBP-CB system	Total DREEM	1	0.855	0.763	0.865	0.908	0.671
	SPL		1	0.579	0.762	0.709	0.509
	SPT			1	0.505	0.607	0.349
	SAP				1	0.766	0.578
	SPA					1	0.568
	SSP						1

Note: P values of all correlation coefficients are < 0.0001.

Abbreviations: DREEM, Dundee Ready Education Environment Measure; SPL, student's perceptions of learning; SPT, student's perceptions of teachers; SAP, student's academic self-perceptions; SPA, student's perceptions of atmosphere; SSP, student's social self-perception.

**Table 11** Comparison Between the Traditional MBBCH and Integrated MSBP-CB Systems Regarding the Achievements of Students

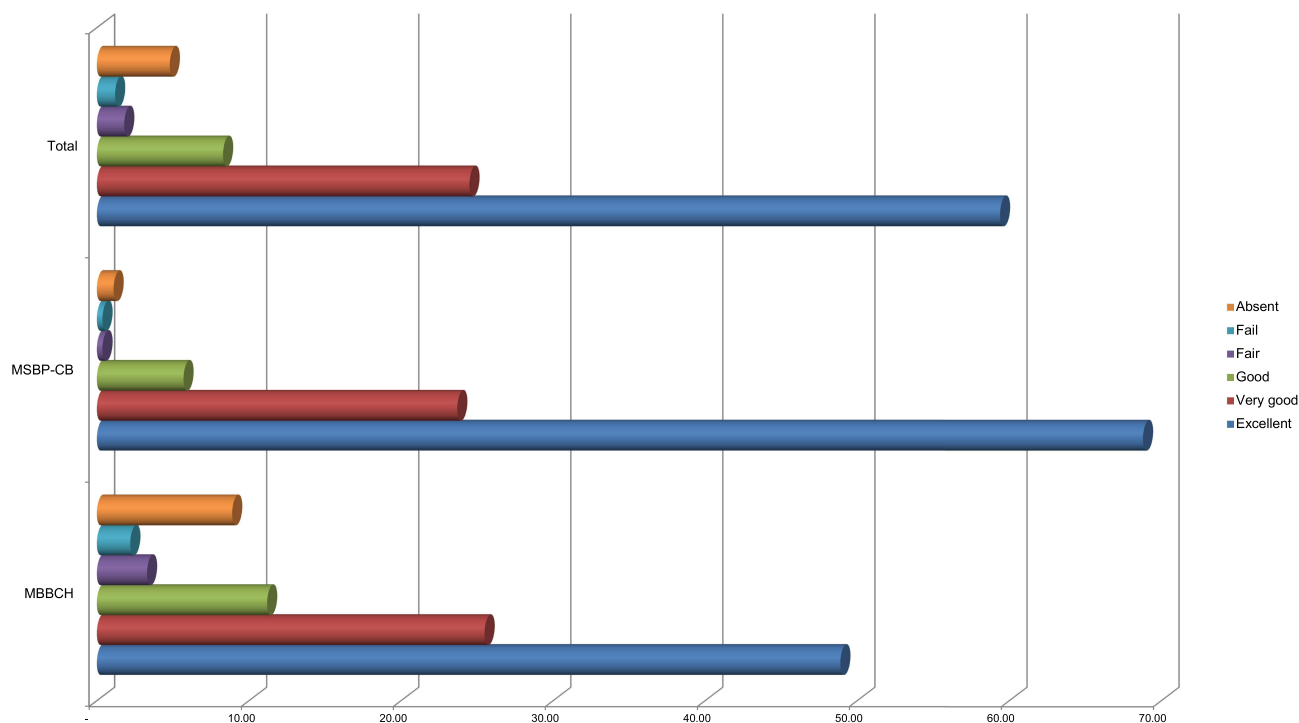
Achievement of Students	Traditional MBBCH System (n=961)		Integrated MSBP-CB System (n=1076)		Total (n=2037)		Z Score Test	p value
	n	%	n	%	n	%		
Excellent	470	48.9	740	68.8	1210	59.4	-9.1143	<0.00001*
Very good	244	25.5	256	23.7	500	24.5	0.8368	0.4009
Good	108	11.2	61	5.7	169	8.3	4.549	<0.00001*
Fair	32	3.3	4	0.37	36	1.8	5.0583	<0.00001*
Fail	21	2.2	4	0.37	25	1.2	3.711	0.0002*
Absent	86	8.9	11	1.1	97	4.8	8.3863	<0.00001*

Note: \*Significant at <0.05.

Abbreviation: n, number.

deciding to transition. However, changes in the academic potentials between students in different programs might be another justification.<sup>19</sup>

This study revealed more positive attitudes regarding students' perceptions of the learning environment and not-too-bad students' SSP. Students enrolled in the integrated system, although their experience is less disappointing and they appreciate a good support system for students who have stress, could make good friends significantly more easily than those in the traditional curriculum. These findings are consistent with those of previous studies.<sup>19</sup> Similarly, it was reported that SPA and SAP were better in students enrolled in paraclinical years than in those in clinical years.<sup>20</sup> It is well



**Figure 6** Comparing the traditional MBBCH and the integrated MSBP-CB systems regarding the achievements of students.

known that medical students in all programs are more prone than other students to face stress, develop anxiety and depression symptoms, and lack appropriate strategies for coping with stress. Fear of failure, unsuitable learning environments, and unsatisfactory teaching strategies are among the most common causes of physical and mental disorders in medical students.<sup>21</sup> Well-designed curricula can enable appreciating the role of mentorship, student counseling, and guidance such that students are eligible to approach faculties periodically. Moreover, studying in small groups, such in Problem-Based Learning (PBL), or in teams and participating in community-based activities, which are characteristic features of integrated curricula, enable academic advisors to tackle students who need help, thus assisting and offering them scaffolds to bridge problems.<sup>22</sup> Additionally, the design of the integrated curriculum helps social interaction between students and promotes their communication skills.

However, our study reported three items that were perceived better by students in the traditional program, that is, that the course was well timetabled and that the teaching time was put to good use, in addition to enjoying a more relaxing atmosphere. These results are partially consistent with those of a study conducted in Kuwait, which revealed that timetable is one weak point presented by students enrolled in the PBL-adopting curriculum. Nevertheless, this study demonstrated an improvement in students' perceptions of the learning environment upon curricular transition, and students reported that the learning environment was more relaxed than before.<sup>19</sup>

In this study, the most positively reported item was "the teachers are knowledgeable" as it had scores of  $>3$  in both systems. This is a strong point for the institution, and as we mentioned before, both programs share the same resources, including tutors. Good, qualified faculties are one of the cardinal pillars that support and positively influence learning environments. The role of knowledgeable faculties in improving a learning environment has been thoroughly reported in different contexts.<sup>7,23,24</sup>

Our study also reported weaknesses that are common to both systems, including the overemphasis on factual learning and learning that is too teacher centered. These two weaknesses, with similar scores, were reported in other studies where traditional curricula were delivered.<sup>25,26</sup> However, recently-structured curricula also suffer from a lack of emphasis on factual teaching, which might explain the poor perception of this item among students in the integrated curriculum in this study.<sup>27</sup> These findings require that more attention be paid to social accountability when designing curricula and

**Table 12** Summary of the Selected Studies Showing Medical Students' Perceptions Using the DREEM Inventory at National and Worldwide Levels from 2008 to 2021

Research, Publication and Year	College, University and Country	(Response Rate), Student Level or Phase,	Program	Sample Size Number (%) of Male and Female Gender Significance	Overall DREEM Score and its Subscales	The Most Positive Items	The Weakest Items
<b>The current study, 2021</b>	Faculty of Medicine, Tanta University, Egypt	(86.9%) Second year (basic phase) and fourth year (clinical phase) students	Traditional subject-based MBBCH program and an integrated MSBP-CB program	621 students 302 (48.6%) male and 319 (51.4%) female Females showed higher overall DREEM, SPA, SAP, scores and significant higher SPT scores than males. Males should higher SSP	Overall, 121.04 (121.81 for year 2 and 120.25 for year 4)	No items scored >3.5. The highest scored item that ranked above 3 was: 2. The teachers are knowledgeable (3.21 for year 2 and 3.28 for year 4)	Items scored less than 2 were: 4. I am too tired to enjoy this course (1.63 for year 2 and 1.58 for year 4) 17. Cheating is a problem in this course (1.88 for year 2) 25. The teaching over emphasizes factual learning (1.6 for year 2 and 1.45 for year 4) 27. I am able to memorize all I need (1.39 for both years 2 and 4) 48. The teaching is too teacher-centered (1.75 for year 2 and 1.5 for year 4) 50. The students irritate the teachers (1.88 for year 2)
					SPL 26.18 (26.57 for year 2, and 25.78 for year 4)		
					SPT 29.06 (29.16 for year 2, and 28.97 for year 4)		
					SAP 19.17 (19.64 for year 2, and 18.69 for year 4)		
					SPA 27.95 (27.64 for year 2, and 28.28 for year 4)		
					SSP 16.06 (16.14 for year 2, and 15.98 for year 4)		
<b>(Salih et al, 2018)</b>	Faculty of Medicine, University of Bahri, Sudan	24.5% All years, basic and clinical phases (1-6)	Mixed (hybrid) curriculum	347 students More male than female. Male showed significantly higher scores (overall DREEM and in all subscales) than females	Overall, (132)	Not mentioned	Not mentioned
					SPL (32)		
					SPT (30)		
					SAP (21)		
					SPA (26)		
					SSP (17)		
<b>(Soliman et al, 2017)</b>	College of Medicine at King Saud University, Saudi Arabia	(25.3%) Fifth year (clinical phase)	System-oriented hybrid curriculum	62 students 33 (53.3%) males and 29 (46.7%) females Insignificant differences (overall and in DREEM subscales) between male and females	Overall, (171.57/250) *	The highest scored items more than 4 were: 2. The teachers are knowledgeable (4.01) 10. I am confident about passing this year (4.03) 15. I have good friends in this school (4.33)	The lowest scored item was: 35. I find the experience disappointing (2.7)
					SPL (40.17)		
					SPT (33.35)		
					SAP (28.4)		
					SPA (41.32)		
					SSP (24.33)		

(Continued)

Table 12 (Continued).

Research, Publication and Year	College, University and Country	(Response Rate), Student Level or Phase,	Program	Sample Size Number (%) of Male and Female Gender Significance	Overall DREEM Score and its Subscales	The Most Positive Items	The Weakest Items
(Sengupta et al, 2017)	Nil Ratan Sircar Medical College, West Bengal University of Health Sciences (WBUHS) Kolkata, West Bengal, India.	(87.5%) Fifth semester batch	Traditional subject-based program	200 students 125 (62.5%) male and 75 (37.5%) female Gender differences were not assessed	Overall, (119.64) SPL (28.0995) SPT (30.41) SAP (19.711) SPA (27.45) SSP (14.47)	Not mentioned	Not mentioned
	College of Medicine and Sagore Dutta Hospital, West Bengal University of Health Sciences (WBUHS), Kolkata, West Bengal, India.	(86%) Fifth semester batch	Traditional subject-based program	78 students 53 (67.9%) male and 25 (32.1%) female Gender differences were not assessed	Overall, (119.11) SPL (29.375) SPT (29.56) SAP (20.248) SPA (25.65) SSP (14.675)	Not mentioned	Not mentioned
(Patil and Chaudhari, 2016)	Terna Medical College, Navi Mumbai, Indi	(85.71%) Fifth semester (paraclinical phase), seventh, and ninth semesters, and interns (clinical phase)	Traditional subject-based program	262 students 121 (46.2%) male and 141 (53.8%) female Gender differences were not assessed	Overall, 123 (135.05 for 5th, 119.00 for 7th, 117.60 for 9th and 120.11 for interns) SPL (32.70 for 5th, 27.02 for 7th, 26.93 for 9th and 28.54 for interns) SPT (29.10 for 5th 26.18 for 7th, 25.17 for 9th and 25.79 for interns) SAP (23.06 for 5th 19.77 for 7th, 20.45 for 9th and 21.34 for interns) SPA (31.43 for 5th 28.76 for 7th 28.21 for 9th and 27.84 for interns) SSP (18.75 for 5th 17.29 for 7th, 16.80 for 9th and 16.59 for interns)	No items scored > 3.5. The three highest scored items were: 10. I am confident about my passing this year (3.35) 15. I have good friends in this school (3.32) 2. The teachers are knowledgeable (3.02)	Items scored less than 2 were: 9. The teachers are authoritarian (1.84) 25. The teaching over- emphasizes factual learning (1.87) 39. The teachers get angry in class (1.87) 48. The teaching is too teacher-centered (1.94)

<b>(Bhosale, 2015)</b>	Smt. Kashibai Navale Medical College and General Hospital, Western Maharashtra, India	(92.68%) Three years medical students (year 1, 2, and 3) enrolled for more than three months	Not mentioned	380 students 175 (46.1%) male and 205 (53.9%) female. Female showed significantly higher SPL, SAP and overall DREEM score	Overall, 136 (131.4 for year 1, 141.3 for year 2, and 135.3 for year 3)	Item scored above 3 (in different years) were: 13. The teaching is student-centered 25. The teaching over emphasizes factual learning 27. I am able to memorize all I need 31. I have learned a lot about empathy in my profession 47. Long-term learning is emphasized over short-term learning 48. The teaching is too teacher-centered Highest Scores >3.5 (in different years) were: 2. The teachers are knowledgeable 10. I am confident about passing this year 15. I have good friends in this school 19. My social life is good	Items scored less than 2 (in different years) were: 8. The teachers ridicule the students 16. The teaching helps to develop my competence 28. I seldom feel lonely 44. The teaching encourages me to be an active learner 45. Much of what I have to learn seems relevant to a career in healthcare 46. My accommodation is pleasant Lowest scores (in different years) were: 3. There is a good support system for students who get stressed 4. I am too tired to enjoy this course 9. The teachers are authoritarian 14. I am rarely bored on this school 25. The teaching over emphasizes factual learning 27. I am able to memorize all I need
					SPL 35.5 (34.5 for year 1, 37.8 for year 2, and 34.2 for year 3)		
					SPT 30.9 (27.8 for year 1, 31.6 for year 2, and 33.2 for year 3)		
					SAP 21 (18.3 for year 1, 22.3 for year 2, and 22.4 for year 3)		
					SPA 29.8 (29.2 for year 1, 30.2 for year 2, and 30.1 for year 3)		
					SSP 16.1 in (16.6 for year 1, 16.4 for year 2, and 15.4 for year 3)		

(Continued)

Table 12 (Continued).

Research, Publication and Year	College, University and Country	(Response Rate), Student Level or Phase,	Program	Sample Size Number (%) of Male and Female Gender Significance	Overall DREEM Score and its Subscales	The Most Positive Items	The Weakest Items
<b>(Abdulwahab and Abdulbari, 2014)</b>	College of Medicine, University of Basrah, Iraq	(72.8%) Fourth year students (clinical phase)	Traditional subject-based program	91 students 36 (39.56%) males and 55 (60.44%) females Insignificant gender variations (overall and in different subscales)	Overall, (93.5714)	No item scored more than 3.	Items scored less than 2 were: 1. I am encouraged to participate in class (1.93) 3. There is a good support system for students who get stressed (3.04) 4. I am too tired to enjoy this course (0.84) 5. Learning strategies which worked for me before continue to work for me now (1.79) 7. The teaching is often stimulating (1.93) 8. The teachers ridicule the students (0.87) 9. The teachers are authoritarian (0.95) 10. I am confident about passing this year (1.86) 11. The atmosphere is relaxed during the ward teaching (1.64) 14. I am rarely bored on this school (1.20) 16. The teaching helps to develop my competence (1.91) 21. I feel I am being well prepared for my profession (1.57) 23. The atmosphere is relaxed during lectures (1.62) 25. The teaching over emphasizes factual learning (1.98) 26. Last year's work has been a good preparation for this year's work (1.50) 28. I seldom feel lonely (1.95) 27. I am able to memorize all I need (1.50) 30. There are opportunities for me to develop interpersonal skills (1.29) 32. The teachers provide constructive criticism here (1.52) 33. I feel comfortable in class socially (1.87) 34. The atmosphere is relaxed during seminars/tutorials (1.70) 37. The teachers give clear examples (1.93) 39. The teachers get angry in the class (1.75) 42. The enjoyment outweighs the stress of the course (1.00) 43. The atmosphere motivates me as a learner (1.29) 48. The teaching is too teacher-centered (1.74) 49. I feel able to ask the questions I want (1.76)
					SPL (23.8901)		
					SPT (20.1648)		
					SAP (15.3516)		
					SPA (20.5055)		
					SSP (13.6154)		

<b>(Yusoff et al, 2013)</b>	School of Medical Sciences, Universiti Sains Malaysia, Kubang Kerian, Kelantan, Malaysia	(77.9%) First year (preclinical phase), third year (paraclinical phase) And fifth year (clinical phase) students	A self-directed, problem-based, integrated, community-oriented curriculum	511 students 175 (34.2%) male and 312 (61.1%) female and 24 (4.7) missed gender data Gender variations were not assessed	Overall, 128.36 (138.94 for year 1, 122.27 for year 3 and 125.49 for year 5)	Items scored more than 3 in one of years or overall were: 2. The teachers are knowledgeable (3.30 for year 1, 3.16 for year 3, 3.19 for year 5) 18. The teachers have good (3.03 for year 1 and 3.01 for year 5) communication skills with patients 24. The teaching time is put to good use (3.05 for year 1) 37. The teachers give clear examples (3.02 for year 1) 40. The teachers are well-prepared for their teaching sessions (3.05 for year 1) 44. The teaching encourages me to be an active learner (3.03 for year 1)	Items showed less than 2 in one of years or overall were: 8. The teachers ridicule the students (1.94 for year 5) 9. The teachers are authoritarian (1.85 for year 3, and 1.84 for year 5) 11. The atmosphere is relaxed during ward teaching (1.93 for year 3) 17. Cheating is a problem in this school (1.53 for year 5) 25. The teaching over-emphasizes factual learning (1.13 for year 1, 1.36 for year 3 and 1.52 for year 5) 27. I am able to memorize all I need (1.69 for year 3, and 1.74 for year 5) 48. The teaching is too teacher-centred (1.96 for year 1 and 1.97 for year 3) 39. The teachers get angry in teaching (1.86 for year 5) 50. The students irritate the teachers (1.83 for year 5)
					SPL 31.18 (33.33 for year 1, 29.4 for year 3 and 31.3 for year 5)		
					SPT 28.04 (30.28 for year 1, 26.77 for year 3 and 27.42 for year 5)		
					SAP 20.87 (22.59 for year 1, 19.64 for year 3 and 20.68 for year 5)		
					SPA 30.96 (34.21 for year 1, 29.58 for year 3 and 25.48 for year 5)		
					SSP 17.30 (18.54 for year 1, 16.87 for year 3 and 16.62 for year 5)		

(Continued)

Table 12 (Continued).

Research, Publication and Year	College, University and Country	(Response Rate), Student Level or Phase,	Program	Sample Size Number (%) of Male and Female Gender Significance	Overall DREEM Score and its Subscales	The Most Positive Items	The Weakest Items
(Zawawi and Elzubeir, 2012)**	College of Medicine, King Saud bin Abdulaziz University for Health Sciences, Riyadh, Saudi Arabia	(73%) Final year of 4-years graduate entry curriculum	Hybrid PBL, integrated and traditional program	27 students 100% male Gender comparison was infeasible	Overall, (131) SPL (36.44) SPT (25.48) SAP (19.81) SPA (32.77) SSP (16.81)	Items scored above 3 were: 7. The teaching is often stimulating (3.37) 13. The teaching is student-centered (3.19) 20. The teaching is well focused (3.22) 23. The atmosphere motivates me as a learner (3.07) 41. My problem-solving skills are being well developed here (3.40) 47. Long-term learning is emphasized over short-term learning (3.19)	Not mentioned
	College of Medicine, King Saud University, Riyadh, Saudi Arabia	(23%) Final year of 6-years high school entry curriculum	Traditional subject-based program	74 students 61 (82.4%) male, 13 (17.6%) female Female responses were considered as missed data. Gender comparison was not conducted	Overall, (100) SPL (23.18) SPT (23.79) SAP (13.59) SPA (24.66) SSP (15.37)	Not mentioned	Items showed less than 2 were: 7. The teaching is often stimulating (1.62) 13. The teaching is student-centered (1.72) 20. The teaching is well focused (1.65) 23. The atmosphere motivates me as a learner (1.77) 41. My problem-solving skills are being well developed here (1.83) 47. Long-term learning is emphasized over short-term learning (1.89)



<b>(Nahar et al, 2010)</b>	Fifteen medical colleges in Bangladesh	(100% due to purposive sampling) Clinical years (3rd, 4th, 5th years students) Divided into academic achievers and under-achievers	Not mentioned (seemed traditional)	1610 students 808 (50.2%) males and 802 (49.8%) females Females showed significantly higher scores among both studied groups	Overall, (110.15 for academic achievers and 106.89 for under-achievers)	Items scored above 3 were: 7. The teaching is often stimulating (3.22 for academic achievers and 3.12 for under-achievers) 2. The teachers are knowledgeable (3.11 for academic achievers and 3.02 for under-achievers) 15. I have good friends in this school (3.020 for academic achievers) 33. I feel comfortable in class socially (3.02 for academic achievers)	3. There is a good support system for students who get stressed (1.13 for academic achievers and 1.16 for under-achievers) 4. I am too tired to enjoy this course (1.37 for academic achievers and 1.19 for under-achievers) 8. The teachers ridicule the students (1.15 for academic achievers and 1.03 for under-achievers) 9. The teachers are authoritarian (1.78 for academic achievers and 1.54 for under-achievers) 11. The atmosphere is relaxed during the ward teaching (1.65 for academic achievers and 1.62 for under-achievers) 13. The teaching is student-centred (1.31 for academic achievers and for under-achievers) 14. I am rarely bored on this school (1.78 for academic achievers and 1.93 for under-achievers) 17. Cheating is a problem in this course (1.56 for academic achievers and 1.51 for under-achievers) 23. The atmosphere is relaxed during lectures (1.83 for academic achievers and 1.70 for under-achievers) 25. The teaching over emphasizes factual learning (1.23 for academic achievers and 1.32 for under-achievers) 27. I am able to memorize all I need (1.77 for academic achievers and 1.67 for under-achievers) 35. I find the experience disappointing (1.51 for academic achievers and 1.36 for under-achievers) 39. The teachers get angry in the class (1.72 for academic achievers and 1.49 for under-achievers) 42. The enjoyment outweighs the stress of the course (1.61 for academic achievers and 1.54 for under-achievers) 46. My accommodation is pleasant (1.74 for academic achievers and 1.77 for under-achievers) 48. The teaching is too teacher-centered (1.33 for academic achievers and 1.34 for under-achievers) 49. I feel able to ask the questions I want (1.61 for academic achievers and 1.55 for under-achievers)
					SPL (27.67 for academic achievers and 27.32 for under-achievers)		
					SPT (24.28 for academic achievers and 23.47 for under-achievers)		
					SAP (19.56 for academic achievers and 18.51 for under-achievers)		
					SPA (24.33 for academic achievers and 23.2 for under-achievers)		
					SSP (14.35 for academic achievers and 14.25 for under-achievers)		

(Continued)

Table 12 (Continued).

Research, Publication and Year	College, University and Country	(Response Rate), Student Level or Phase,	Program	Sample Size Number (%) of Male and Female Gender Significance	Overall DREEM Score and its Subscales	The Most Positive Items	The Weakest Items
<b>(Aghamolaei and Fazel, 2010)</b>	Hormozgan University of Medical Science, Iran	(86.6%) Students enrolled in pre-clinical pathophysiology course and students enrolled on clinical course.	Traditional system	182 students About 70 (38.5%) male and about 112 (61.5%) females Insignificant gender differences were reported	Overall (99.6)	No items scored 3 or above	Items showed less than 2 were: 1. I am encouraged to participate in class. (1.9) 3. There is a good support system for students who get stressed (1.1) 4. I am too tired to enjoy this course (1.6) 5. Learning strategies which worked for me before continue to work for me now (1.6) 7. The teaching is often stimulating (1.8) 11. The atmosphere is relaxed during the ward teaching (1.9) 12. This school is well timetabled (1.2) 13. The teaching is student-centered (1.7) 21. I feel I am being well prepared for my profession (1.9) 22. The teaching helps to develop my confidence (1.7) 25. The teaching over emphasizes factual learning (1.6) 26. Last year's work has been a good preparation for this year's work (1.8) 27. I am able to memorize all I need (1.8) 31. I have learned a lot about empathy in my profession (1.7) 32. The teachers provide constructive criticism here (1.8) 36. I am able to concentrate well (1.9) 38. I am clear about the learning objectives of the course (1.9) 43. The atmosphere motivates me as a learner (1.5) 44. The teaching encourages me to be an active learner (1.7) 47. Long-term learning is emphasized over short-term learning (1.4) 48. The teaching is too teacher-centered (1.5) 49. I feel able to ask the questions I want (1.8)
					SPL (21.2)		
					SPT (24.2)		
					SAP (15.8)		
					SPA (23.8)		
					SSP (14.5)		

<b>(Bennett et al, 2010)</b>	School of Medicine in University College Cork, Ireland	(100%) Year 3 medical students distributed over six hospitals (small and large) providing clinical teaching	Not mentioned (seemed integrated)	108 students completed 216 surveys, out of them 108 were analyzed 51 (47.2%) male and 57 (52.8%) female. On large hospitals, significant differences were reported between males and females on the academic and social self-perception subscales, with males showing higher scores.	Overall, 149.47 (140.77 for large hospitals and 152.86 for small hospitals)  SPL 36.59 (32.16 for large hospitals and 38.13 for small hospitals)  SPT 34.37 (32.45 for large hospitals and 35.05 for small hospitals)  SAP 22.66 (23.53 for large hospitals and 22.74 for small hospitals)  SPA 36.38 (33.53 for large hospitals and 37.37 for small hospitals)  SSP 19.46 (19.1 for large hospitals and 19.57 for small hospitals)	One item scored above 3 was: 1. I am encouraged to participate during tutorials/ tutor teaching/bedside teaching (3.56 for small hospitals)	No items scored below 2
<b>(Denz-Penhey and Murdoch, 2010)</b>	The Rural Clinical School of Western Australia (RCSWA), Australia	(Response rate was not mentioned) Year 5 and year 6 students, including students trained at Metropolitan hospital, those in training sites with populations of less than 20,000 and those at sites with populations of greater than 30,000	Integrated Community Learning in Rural Communities program (CLERC)	342 students distributed over 10 training sites Gender distribution was not mentioned	Overall, (147.4 for large hospitals and 159.1 for small hospitals)  SPL (34.6 for large hospitals and 39.5 for small hospitals)  SPT (34.0 for large hospitals and 34.9 for small hospitals)  SAP (21.1 for large hospitals and 23.3 for small hospitals)  SPA (37.0 for large hospitals and 38.3 for small hospitals)  SSP (20.5 for large hospitals and 21.8 for small hospitals)	Not mentioned	Not mentioned

(Continued)

Table 12 (Continued).

Research, Publication and Year	College, University and Country	(Response Rate), Student Level or Phase,	Program	Sample Size Number (%) of Male and Female Gender Significance	Overall DREEM Score and its Subscales	The Most Positive Items	The Weakest Items
(Edgren et al, 2010)	Lund University, Sweden	(82% in 203 and 75% in 2005) Same students enrolled in semester 2 S2 (pre-clinical phase), semester 6 S6 (first clinical rotation) and 10 S10 (well- clinical phase before graduation). Scores of 2003 and 2005 were compared	Reformed curriculum (horizontal and vertical integration, PBL based)	201 students about 83 (41.1%) males and 118 (58.9%) females. Gender differences were not mentioned	Overall, (144 for 2003 and 146 for 2005)	Item scored above 3.5 were: 2. The teachers are knowledgeable (3.5 for S4, 2003, 3.5 for S2 and S10 2005) 7. The teaching is often stimulating (3.5 for S2, 2003) 8. The teachers ridicule the students (3.5 for S10, 2003) 15. I have good friends in this school (3.5 for S2, 2005) 16. The teaching is sufficiently concerned to develop my competence (3.5 for S2, 2003) 17. Cheating is a problem in this school (3.5 for S2, 2003, 3.6 for S10, 2003, 3.5 for S2, S10 2005) 19. My social life is good (3.5 for S6, 2005) 30. There are opportunities for me to develop interpersonal skills (3.5 for S10, 2005) 33. I feel comfortable in class socially (3.5 for S2, S6, 2005 and 3.6 for S10, 2005) 39. The teachers get angry in class (3.6 for S2, 2003, 3.7 for S10, 2003, 3.6 for S2, S10, 205) 45. Much of what I have to learn seems relevant to a career in medicine (3.6 for S6, 2003, 3.6 for S6, 2005 and 3.5 for S10, 2005) 46. My accommodation is pleasant (3.5 for S2, 2003, 3.6 for S6, 2003, 3.7 for S10, 2003 and S2, 2005, 3.8 for S6, 2005, 3.6 for S10, 2005)	Items scored below 2 were: 3. There is a good support system for students who get stressed (1.7 for S2, 2003, 1.6 for S6, 2003, 1.5 for S10, 2003, 1.3 for S6, 2005 and 1.7 for S10, 2005) 14. I am rarely bored on this course (1.7 for S10, 2003) 24. The teaching time is put to good use (1.8 for S10, 2003) 29. The teachers are good at providing feedback to students (1.8 for S2, 2003 and S2, 2005, 2 for S6, 2003 and S6, 2005) 32. The teachers provide constructive criticism here (1.4 for S2, 2003, 1.9 for S6, 2003, 2.0 for S10, 2003 and 1.4 for S2, 2005)
					SPL (34 for 2003 and 34 for 2005)		
					SPT (30 for 2003 and 31 for 2005)		
					SAP (23 for 2003 and 22 for 2005)		
					SPA (37 for 2003 and 38 for 2005)		
					SSP (20 for 2003 and 21 for 2005)		

<b>(Bouhaimed et al, 2009)</b>	Faculty of Medicine, Kuwait University, Kuwait	(86% of the first year and 89% of the second year) First and second years' students	Curricular reform from a traditional (year 1) to a problem-based learning following Maastricht model program (year 2)	202 students 51 (25.2%) male and 144 (71.3) female while 7 students did not mention their gender. Significant gender differences were noticed where female showed significant less overall score and some less different subscales	Overall, 105 (106 for year 1 and 106 for year 2)	Not mentioned. However, the following items were reported as causes of improved score: 17. Cheating is a problem in this school 23. The atmosphere is relaxed during lectures 34. The atmosphere is relaxed during seminars/tutorials.	Not mentioned. However, the following items were responsible for low scores: 5. Learning strategies which worked for me before continue to work for me now 26. Last year's work had been a good preparation for this year's work. 12. This school is well timetabled' scores for students in the PBL system
					SPL 26 (26 for year 1 and 26 for year 2)		
					SPT 24 (24 for year 1 and 24 for year 2)		
					SAP 16 (17 for year 1 and 15 for year 2)		
					SPA 25 (24 for year 1 and 26 for year 2)		
					SSP 14 (15 for year 1 and 14 for year 2)		
<b>(Riquelme et al, 2009)</b>	Pontificia Universidad Católica de Chile Medical School, Chile	(Overall response rate 90.5%) medical students in Years 3, 4 and 5	Major curriculum reform	297 students 159 (53.5%) males and 138 (46.5%) females Gender differences were not assessed	Overall 127.5 (128.8 for year 3, 132.5 for year 4, and 119.3 for year 5)	Item scored above 3.5 were: 2. The teachers are knowledgeable (3.65) 15. I have good friends in this school (3.59)	Items scored below 2 were: 3. There is a good support system for students who get stressed (1.16) 4. I am too tired to enjoy the course (1.76) 12. This school is well time-tabled (1.97) 14. I am rarely bored on this course (1.9) 17. Cheating is a problem in this school (1.2) 25. The teaching over-emphasizes factual learning (1.37) 27. I am able to memorize all I need (1.64) 29. The teachers are good at providing feedback to students (1.74) 46. My accommodation is pleasant (1.68)
					SPL 28.7 (29.7 for year3, 29.6 for year 4, and 26.4 for year 5)		
					SPT 30.3 (31.1 for year3, 31.2 for year 4, 28.3 and for year 5)		
					SAP 22.3 (22.6 for year3, 22.6 for year 4, and 21.4 for year 5)		
					SPA 30.2 (29.7 for year3, 32.0 for year 4, and 28.3 for year 5)		
					SSP 15.9 (15.6 for year3, 17.1 for year 4, and 14.9 for year 5)		

(Continued)

Table 12 (Continued).

Research, Publication and Year	College, University and Country	(Response Rate), Student Level or Phase,	Program	Sample Size Number (%) of Male and Female Gender Significance	Overall DREEM Score and its Subscales	The Most Positive Items	The Weakest Items
(Carmody et al, 2009)	Different clinical training contexts (tertiary, secondary and rural sites) in metropolitan region, Australia	(94%) Year 5 students enrolled in obstetrics and gynecology course	Not mentioned	161 students 73 (45%) male and 88 (55%) female. No significant gender variations.	Overall, 149 (148.8 for tertiary hospitals, 151.9 for secondary/tertiary hospitals, 141.9 for small rural sites and 148.9 for large rural sites)	Not mentioned	Not mentioned
					SPL (36.7 for tertiary hospitals, 37.2 for secondary/tertiary hospitals, 34.4 for small rural sites and 36.9 for large rural sites)		
					SPT (34.7 for tertiary hospitals, 35 for secondary/tertiary hospitals, 34.2 for small rural sites and 35.6 for large rural sites)		
					SAP (21.6 for tertiary hospitals, 22.9 for secondary/tertiary hospitals, 20.5 for small rural sites and 21.1 for large rural sites)		
					SPA (36.3 for tertiary hospitals, 36.8 for secondary/tertiary hospitals, 33.2 for small rural sites and 35.2 for large rural sites)		
					SSP (19.5 for tertiary hospitals, 20.2 for secondary/tertiary hospitals, 19.7 for small rural sites and 20.1 for large rural sites)		

<b>(Denz-Penhey and Murdoch, 2009)</b>	Rural Clinical School of Western Australia, Australia	(Response rate mentioned as low) year 5 undergraduate students at University of Western Australia and year 3 students at University of Notre Dame during rural training. Students are distributed over 10 sites	Not mentioned	62 students. Gender distribution was not mentioned. Females showed higher overall scores than males, but this difference was insignificant.	Overall (143)	Not mentioned	Scores with lowest scores were: 5. Learning strategies which worked well for me before continue to work for me 27. I am able to memorise all I need 38. I am clear about the learning objectives of the course 50. Students irritate the teachers
					SPL (33.9)		
					SPT (32.6)		
					SAP (21.5)		
					SPA (35.6)		
SSP (19.3)							
<b>(McKendree, 2009)</b>	Two different campuses (Hull and York), Hull York Medical School, UK.	(90.6% for Year 1) and (69.8% for Year 2 students)	Integrated PBL-based curriculum	216 students Gender distribution and differences were not mentioned	Overall, 143.3 (145.2 for Hull and 141.4 for York)	Not mentioned	Not mentioned
					SPL 34.2 (35 for Hull and 33.4 for York)		
					SPT 32.5 (33 for Hull and 32 for York)		
					SAP 21.4 (21.3 for Hull and 21.4 for York)		
					SPA 35.5 (35.9 for Hull and 35.1 for York)		
SSP 19.7 (19.9 for Hull and 19.5for York)							
<b>(Miles and Leinster, 2009)</b>	University of East Anglia, United Kingdom	(90% for students). Year 1 to year 4 students and staff members**	UEA MB/BS program (PBL-based curriculum)	403 students 73 staff members 158 (39.21%) male and 245 (60.79%) female students. 44 (60.27%) Male and 29 (39.73%) female staff Gender differences were not mentioned	Overall (141 for students and 144 for staff)	Among participating students, no items scored above (3.5) Among staff, one item score was above 3.5: The students are encouraged to participate in class (3.58)	Among participating students, items scored below 2 were: 27. I am able to memorize all I need (1.75) 29. The teachers are good at providing feedback to students (1.82) Among staff, one item scored less than 2 was: The students are able to memorize all they need (1.89)
					SPL (34.04 for students and 36.75 for staff)		
					SPT (31.01 for students and 32.99 for staff)		
					SAP (21.34 for students and 21.18 for staff)		
					SPA (34.54 for students and 35.12 for staff)		
SSP (20.30 for students and 17.90 for staff)							

(Continued)

Table 12 (Continued).

Research, Publication and Year	College, University and Country	(Response Rate), Student Level or Phase,	Program	Sample Size Number (%) of Male and Female Gender Significance	Overall DREEM Score and its Subscales	The Most Positive Items	The Weakest Items
(Abraham et al, 2008)	Melaka Manipal Medical College, Maniapal, India	(100%) First year students and Clinical year students	Not mentioned (seemed traditional)	Out of 226 participated, 211 students' responses were complete. Out of 211 complete responses, 114 (54.02%) male and 97 (45.98%) female students. Insignificant gender variations were noticed in all studied cohorts. First year showed significant differences in some items with females higher scores than males	Overall, 116.5 (119 for the first year and 114 for the clinical year)	Item scored above 3 were: 2. The course organizers are knowledgeable (3.22 for first year) 10. I am confident about passing this year (3.12 for clinical year) 15. I have good friends in this course (3.21 for first year) 40. The course organizers are well prepared for their teaching sessions (3.06 for first year)	Items scored below 2 were: 4. I am too tired to enjoy this course (1.67 for first year, 1.59 for clinical year) 5. Learning strategies which worked for me before continue to work for me now (1.86 for first year) 6. The course organizers espouse a patient centered approach to consulting (1.97 for first year) 8. The course organizers ridicule their registrars (1.94 for first year, 1.88 for clinical year) 9. The course organizers are authoritarian (1.54 for first year, 1.57 for clinical year) 14. I am rarely bored on this course (1.78 for first year, 1.69 for clinical year) 25. The teaching overemphasizes factual learning (1.5 for first year, 1.57 for clinical year) 26. Last years work has been a good preparation for this years work (1.89 for first year). 27. I am able to memorize all I need (1.39 for first year, 1.68 for clinical year) 28. I seldom feel lonely (1.99 for clinical year) 39. The course organizers get angry in teaching sessions (1.55 for clinical year) 42. The enjoyment outweighs the stress of studying medicine (1.76 for first year, 1.62 for clinical year) 48. The teaching is too teacher centered (1.58 for first year, 1.59 for clinical year) 50. I feel able to ask the questions I want (1.96 for clinical year)
					SPL (29 for the first year and 27 for the clinical year)		
					SPT (26 for the first year and 30 for the clinical year)		
					SAP (19 for the first year and 20 for the clinical year)		
					SPA (28 for the first year and 30 for the clinical year)		
					SSP (16 for the first year and 15 for the clinical year)		



<b>(Demiroren et al, 2008)</b>	Faculty of Medicine, Ankara University Ankara, Turkey	82.8% Year 1, year 3 (preclinical phase) and year 5 (clinical phase)	Recently restructured curriculum	553 students Gender neither mentioned nor assessed	Overall, 117.63 (for the first year and, for the third year, and for the fifth year)	Items scored more than 3 were: 2. The teachers are knowledgeable (3.26) 15. I have good friends in this school (3.18)	Items scored below 2 were: 3. There is a good support system for students who get stressed (1.7) 4. I am too tired to enjoy this course (1.99) 9. The teachers are authoritarian (1.65) 14. I am rarely bored on this school (1.79) 17. Cheating is a problem in this course (1.76) 24. The teaching time is put to good use (1.53) 25. The teaching over emphasizes factual learning (1.89) 26. Last year's work has been a good preparation for this year's work (1.97) 27. I am able to memorize all I need (1.45)
					SPL 27.82 (27.75 for the first year and, 29.03 for the third year, and 25.79 for the fifth year)		
					SPT 27.51 (27.64 for the first year and, 28.74 for the third year, and 24.96 for the fifth year)		
					SAP 18.78 (17.99 for the first year and, 19.99 for the third year, and 18.50 for the fifth year)		
					SPA 27.03 (26.66 for the first year and, 28.51 for the third year, and 25.23 for the fifth year)		
					SSP 16.50 (16.49 for the first year and, 17.38 for the third year, and 14.92 for the fifth year)		

(Continued)

Table 12 (Continued).

Research, Publication and Year	College, University and Country	(Response Rate), Student Level or Phase,	Program	Sample Size Number (%) of Male and Female Gender Significance	Overall DREEM Score and its Subscales	The Most Positive Items	The Weakest Items
(Al-Ayed and Sheik, 2008)	College of medicine, King Saud University, Riyadh, Saudi Arabia	44.6% All levels including year 1, 2, 3, (preclinical years) and years 4 and 5 students (clinical years)	Pre-changed Traditional subject based program	222 students 155 (69.8%) male and 67 (30.2%) females Insignificant gender differences in overall DREEM and its subscales	Overall, 89.9 (108.6 for 1st, 84.3 for 2nd, 89.3 85.2 for 3rd, 85.2 84.6 for 4th, and 84.6 9.5 for 5th year)	Not mentioned. However, Students' perception of teachers 48.2% (21.2/44) was the highest obtained. Most students agreed that the teachers are knowledgeable	Not mentioned. However, Student's perception of atmosphere was 4th least 4.4% (21.3/48). 24.2% felt relaxed during the ward round 39.9% were relaxed during lectures. Only 25% felt that enjoyment outweighed the stress
					SPL 19.5 (25.6 for 1st, 16.8 19.8 for 2nd, 19.8 for 3rd, 18.1 for 4th, and 18.5 for 5th year)		
					SPT 21.2 (25.5 for 1st, 20.2 22.4 for 2nd, 22.4 19.9 for 3rd, 19.9 19.3 for 4th, and 19.3 8.9 for 5th year)		
					SAP 14.8 (16.9 for 1st, 14.1 for 2nd, 14.3 for 3rd, 14.2 for 4th, and 14.8 for 5th year)		
					SPA 21.3 (25.9 for 1st, 20.5 for 2nd, 20.7 for 3rd, 20.0 for 4th, and 19.6 for 5th year)		
					SSP 13.0 (14.4 for 1st, 12.7 for 2nd, 12.7 for 3rd, 12.8 for 4th, and 12.2 for 5th year)		

**Notes:** \*Overall DREEM was calculated out of 250, \*\*Staff DREEM was used for staff members.

**Abbreviations:** DREEM, Dundee Ready Education Environment Measure; SPL, student's perceptions of learning; SPT, student's perceptions of teachers; SAP, student's academic self-perceptions; SPA, student's perceptions of atmosphere; SSP, student's social self-perception.

endorsing community-based activities as integral components of an integrated system, besides periodic program monitoring and development. The other important point is the faculty development that should be run parallel to the transition process. Faculties should be trained to utilize innovative teaching strategies and assessment tools to allow students to practice Self Directed learning along with proper tutor guidance.<sup>28</sup>

Other weaknesses reported in our study were the poor abilities of students to memorize information and the feeling of being too tired to enjoy a course. These results are consistent with those of previous studies.<sup>14,26,29</sup> Utilizing multiple instructional designs may solve the poor memorization problem. Additionally, periodic assessments of mental and physical health and involvement in extracurricular activities would bring more pleasure and enjoyment during the arduous journey of medical studies.<sup>30</sup>

Another aim of this study was to assess if students' perceptions of their learning environments were influenced by gender, age, or previous GPAs. It was reported that females showed higher overall DREEM scores than males, although the difference was not statistically significant. Furthermore, females showed higher scores than males in all subscales except SSP. These variations were only significant in SPT. Higher perception by females has been thoroughly reported in similar medical schools that implement different programs worldwide.<sup>2,26,31</sup> Other studies have reported variations that were not statistically significant between males and females perception.<sup>17,32</sup> Paradoxically, males in other studies showed a higher perception of their learning environment. A study conducted in Irish large hospitals revealed that academic and SSP subscale scores of males were significantly higher than those of females.<sup>33</sup> A study on Kuwaiti medical students of two different systems (traditional and integrated) also found that female's perceptions of their learning environments were significantly poorer than those of males.<sup>19</sup> Although some studies may attribute gender variations to the segregation of students according to their gender in some countries, which is not the case in Egypt, it is not well known why female's perceptions are better than those of males, and the inconsistent gender variations between this and other studies should be investigated in future studies.<sup>1</sup>

This study also found that younger students had higher perceptions of their learning environments (overall DREEM), which was significant in the learning and student academic perception subscales. However, the perceptions of teachers were significantly better in older students enrolled in the traditional program. In our study, younger students enrolled in basic and preclinical years at King Saud University, Saudi Arabia, showed higher perceptions than older students.<sup>29</sup> Conversely, students in the first year of study showed lower perceptions of their learning environments than those in advanced levels.<sup>27</sup> These variations are intimately related to the curriculum design and the way in which the transition to integration was conducted.

This study expanded on the influence of previous students' achievements (GPAs) on learning environment perception. It was concluded that students with higher GPAs (Excellent) showed significantly higher mean overall DREEM, SPL, SPT, and SAP scores. Moreover, a positive correlation was found between overall DREEM, as well as its subscales, and previous year GPA. These findings are consistent with those of Nahar et al, who reported higher scores among high achievers compared to underachievers.<sup>26</sup> Moreover, our results are partially consistent with those of Mayya and Roff, who reported that higher achievers had better academic self-perceptions and SSP.<sup>34</sup> Thus, efforts should be directed to improving the perceptions of low achievers, which is evidently linked to their academic performances.<sup>35</sup>

The association between students' perceptions of their learning environments and their academic performances became more obvious when the performances of the two cohorts of students (in integrated and traditional programs) were compared. This study reported that students enrolled in the integrated curriculum achieved significantly more excellent grades than those in the traditional program. Moreover, good and fair grades were significantly more common among students of the traditional system, besides the additional cases of failure and higher absence rates. Our findings are consistent with those of Hong-yan et al, who compared the achievements of medical students in the traditional system with those of others who used new integrated techniques and reported significantly higher grades among students who utilized the new techniques.<sup>36</sup>

Consistent with the discussion so far, integration itself is not the aim. Instead, the process of integration aims to enhance students' competencies and upgrade their skills, which is partially reflected in their performances on different assessment platforms. Implementing student-centered, PBL, community-based activities as well as acquiring knowledge

in a system-based manner are reflected as a significant decline in the absence and failure rates among students enrolled in the integrated program.

Our study revealed that the integration of medical curricula in Egypt, as a developing country, seems to be on its way to success. Considering the weaknesses and running faculty development programs alongside the transition process will guarantee a smooth, successful transition. Continuous monitoring and improvement of the learning environment are needed to achieve desired outcomes. Although our study elaborated on various important constituents of the learning environment, some other factors should be addressed in future studies, including the effect of the clinical training resources on students' perceptions.<sup>37,38</sup> Moreover, future studies should assess the faculties' perceptions of their learning environments.<sup>39</sup>

## Limitations and Recommendations

Compared to the total number of students enrolled in both programs, the number of participants was, to some extent, low. This may be attributed to the adoption of a hybrid online system (online lectures and on-campus attendance only for practical sessions) as a measure of limiting the spread of COVID-19. This made it somewhat difficult to meet students. Another possible limitation is that the English version of the survey was administered because the validated Arabic version was not accessible. However, the authors translated a few strange expressions for the students, and both groups study medicine in the English language and are required to pass a placement test with good scores before joining the faculty. Nonetheless, we recommend, where possible, administering the questionnaire in the students' first language to reduce potential misinterpretation of items.

## Conclusion

This study revealed a smooth, successful transition from the traditional to the integrated curriculum among Egyptian medical students. This success is evidenced by the significant improvement in the perception of the learning environment following the aforementioned transition and the significantly higher achievement found among students enrolled in the integrated program. This study conveys more positive than negative perceptions of the learning environment, with more positive learning perceptions, SPT moving in the right direction, SAP being more on the positive side, more positive attitudes regarding students' perceptions of the learning environment, and not-too-bad students' SSPs. Medical students enrolled in the integrated curriculum showed higher DREEM scores, with significantly better learning and academic self-perceptions. Knowledgeable, qualified faculties are the most significant characteristic feature of both systems. Females with high GPAs in previous years showed higher perceptions. Areas for improvements include focusing on factual teaching, implementing student-centered teaching activities, promoting students' ability to memorize, and engaging students in activities that may help them enjoy the learning process.

## Abbreviations

AEC, Assessment and Evaluation Center; DREEM, Dundee Ready Education Environment Measure; GPA, grade point average; MBBCH, Bachelor of Medicine, Bachelor of Surgery; MSBP-CB, Medicine and Surgery Bachelor Program-Credit Points; PBL, problem based learning; REC, Research Ethical Committee; SD, standard deviation; SDL, self directed learning; SAP, student's academic self-perceptions; SPA, student's perceptions of atmosphere; SPL, student's perceptions of learning; SPT, student's perceptions of teachers; SSP, student's social self-perception.

## Institutional Review Board Statement

The current study was carried out after being approved by the Research Ethical Committee (REC) of the Faculty of Medicine, Tanta University (number 34379/1/21).

## Data Sharing Statement

The data analyzed in the current study are available upon reasonable request from the corresponding author.

## Informed Consent Statement

Written informed consent was obtained from every participant prior to their inclusion in the current study.

## Acknowledgments

The authors extend their appreciation for undergraduate medical students of the Faculty of Medicine, Tanta University.

## Author Contributions

All authors contributed to data analysis, drafting or revising the article, have agreed on the journal to which the article will be submitted, gave final approval of the version to be published, and agree to be accountable for all aspects of the work.

## Funding

The authors did not receive any support from funding or nonprofit agencies for this study.

## Disclosure

The authors report no competing interests (financial or non-financial) related to this work.

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