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DOI: 10.4103/jehp.jehp_1772_21

# Perception of educational environment with an assessment of motivational learning strategies and emotional intelligence as factors affecting medical students' academic achievement

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## Abstract

**BACKGROUND:** This study aimed to investigate how medical students perceive their educational environment, as well as the implications of motivation, learning strategies, and the factor of emotional intelligence on academic achievement.

**MATERIALS AND METHODS:** In a cross-sectional study, 3384 undergraduate students were recruited from randomly selected Egyptian medical colleges. Students from second to final year, taking fundamental and clinical courses and, at a minimum, three professional exams, were enrolled and subjected to the Dundee Ready Educational Environment Measure scale, the Motivated Strategies for Learning Questionnaire, and Emotional intelligence questionnaire.

**RESULTS:** The overall mean age of the studied students was  $21.42 \pm 1.61$  years. Females represented 63.5%, rural residents were 52.2% and students with enough income represented 88.0%. The traditional system adopted 28.4% of the students versus 71.6% in the integrated system. Linear regression using path analysis was conducted to study the predictors of academic achievement, and it revealed that motivation was the highly significant predictor of academic achievement ( $\beta = 2.68$ , CI95%:2.35–3.05,  $P < 0.001$ ), followed by learning ( $\beta = 1.09$ , CI95%:0.80–1.41,  $P < 0.001$ ), emotional intelligence ( $\beta = 0.92$ , CI95%:0.87–0.97,  $P < 0.001$ ), and the educational environment ( $\beta = 0.14$ , CI95%:0.13–0.15,  $P < 0.001$ ).

**CONCLUSION:** The study's findings have implications for medical educators trying to understand the personal factors that influence learning and performance in medical school. Students' motivation was the highly significant predictor of academic achievement followed by learning, emotional intelligence, and educational environment. Perception of the learning environment had improved because of the integrated student-centered system, which fosters motivation and emotional intelligence. To improve learners' EI, optimal learning, and educational outcomes, the EI components can be taught and fostered.

## Keywords:

Academic achievement, educational environment, emotional intelligence, integrated teaching, learning strategies, medical education, motivation

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Received: 07-12-2021  
Accepted: 23-02-2022  
Published: 28-09-2022

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**How to cite this article:** Kasemy ZA, Kabbash I, Desouky D, El-Raouf SA, Aloshari S, El Sheikh G. Perception of educational environment with an assessment of motivational learning strategies and emotional intelligence as factors affecting medical students' academic achievement. *J Edu Health Promot* 2022;11:303.

## Introduction

Integral education is a concept that includes the curriculum as an educational program in which the whole is greater than the sum of the parts. Teaching integration is defined as the organization of learning materials to link or combine frequently taught topics into separate academic courses or departments.<sup>[1]</sup> It simply means bridging the links between academic knowledge and practical applications.<sup>[2]</sup> Egypt is adopting new trends and strategies for medical education due to changes in the needs of society and the expansion of understanding that requires the development of existing teaching curricula or the emergence of new methods.<sup>[3]</sup> One such strategy is to move from a discipline-based curriculum to an integrated curriculum as recommended by the National Authority for Quality Assurance and Accreditation in Education (NAQAAE) and the Supreme Council of Universities (SCU) in Egypt, where all medical schools must apply to a certain degree integration with the freedom to choose the type of integrated curriculum that best suits its mission and resources and covers the scope of the competency framework for the National Academic Reference Standards (NARS).<sup>[4]</sup> Prior to this recommendation, all medical schools in Egypt were following traditional discipline-based education but now they are adopting vertical integration which means integration between disciplines that are traditionally taught at different stages of the curriculum.<sup>[5]</sup> Integrated education actively engages students and expands their thinking skills, prevents information overload, and makes the learning environment interactive because it looks at learning and teaching in a holistic way that reflects the real world.

Many factors that may affect the students' academic achievement, such as the learning environment, motivation, and emotional intelligence, require study. The student's learning environment is the climate of the institution in which the student is enrolled. It comprises a variety of aspects such as students' perceptions of campus infrastructure, learning opportunities, instructor abilities and attitudes, peer interaction, and many other factors.<sup>[6]</sup> The learning environment is a concealed curriculum that has a significant impact on student learning. An outstanding atmosphere can demonstrate a high-quality curriculum, although this may be difficult to quantify.<sup>[7]</sup> Pimparyon *et al.*<sup>[8]</sup> discovered a link between learning and educational environment scales. Roff *et al.*<sup>[9]</sup> created the Dundee Ready Education Environment Measure (DREEM) to render the learning environment measurable. A link was discovered between students' DREEM scores and their academic achievement, and it was revealed that top achievers have a more positive outlook on the educational climate.<sup>[10]</sup>

Learners' motivation has long been linked to successful learning, and valid instructional design was found to begin with knowledge of learners' motivation.<sup>[11]</sup> Learning strategies (LS) are defined by Oxford as "engages in activities to assist in the acquisition, storage, retrieval, and use of information. Specific acts made by the student to bring learning to new states that is faster, easier, more successful, pleasurable, self-directed, and more convenient."<sup>[12]</sup> Learning strategies were classified into four categories: cognitive, meta-cognitive, social, and affective strategies.<sup>[13]</sup>

Emotional intelligence (EI) was found to be more responsible for professional success than the Intelligence Quotient, which is the more usual method of measuring intelligence.<sup>[14]</sup> Emotional intelligence is the perception, accessibility, and generation of emotions to help thought and comprehend and govern emotions to improve development intellectually and emotionally.<sup>[15]</sup> Six major abilities should be possessed by a medical graduate: medical knowledge, patient care, practice-based learning, systems-based practice, professionalism, and interpersonal and communication skills. Many elements in these skills are believed to be components of EI.<sup>[16]</sup>

Transition to integrate education is critical to address institutional environmental issues and challenges and to investigate students' perceptions as to how cultural background, religious views, and societal standards influence their perspectives. We also need to look at how the transition affects their academic performance so that we can better assist them in learning. Emotional intelligence is also a new method that requires exploratory attention and evidence of its impact on academic performance.

This study aimed to investigate medical students' perceptions of the educational environment, in addition to the effects of motivation, learning strategies, and emotional intelligence on academic performance.

## Materials and Methods

### Study design and setting

In a cross-sectional study conducted from January to June 2021, 3384 students from three randomly selected, Egyptian medical schools were recruited.

### Study participants and sampling

As the relation between educational environment and medical students academic achievement especially during the current Corona Virus Disease 2019 pandemic is unknown, so the occurrence equals no occurrence = 0.50, sample size has been calculated at CI95% using the following equation  $n = Z^2 P (1 - P) / d^2$  Where n is the sample size, Z is the statistic corresponding to level of confidence,

P is expected proportion with a margin of error of 0.015 and it is estimated to be 3518 students. Taking this low margin of error was to include a large number of students and accounting for a drop-out. Out of the Egyptian medical schools, three schools have been chosen randomly from different geographical areas aiming to give an idea about the education environment in entire Egypt. In these three medical schools, all students from second to final year were enlisted then a proportionate allocation method was applied on two levels; the first one was based on the total number of students in every single medical school and the second one was based on the type of educational system either integrated or traditional. A systematic random sample technique was followed and applied to reach a sample size of 3518 students, but 134 students either refused to participate or uncompleted the questionnaires, so they were excluded from the study with a response rate of 96.1%. Preclinical students were represented in students of second and third year only as we aimed to assess the impact on academic achievement (score) so we excluded the first-year students as they have no prior academic score. The students in their second to final year and agreed to participate in the study were included if they had taken both fundamental and clinical courses and, at a minimum, three professional tests while those who refused to participate in this study, uncompleted the questionnaires or enrolled in the first year as they have no previous academic score were excluded.

### Data collection tool and technique

#### Three tools were used

- I. **The DREEM scale** was deployed to determine the students' perception of the environment within five subscales of 50 items (perceptions of learning, perceptions of teachers, academic self-perceptions, perceptions of atmosphere, and social self-perceptions). Each statement must be read and responded to using a 5-point Likert-type scale, with 4 being strongly agree, 3 being agree, 2 being uncertain, 1 being disagree, and 0 being severely disagree. The overall score varies from 200, which indicates an ideal environment, to zero, which indicates trouble for an institution. The DREEM classifies students' environmental perception as "extremely poor" if the score was 0–50, and "plenty of problems" if the score was 51–100, "more positive than negative" if the score was 101–150, and "outstanding" if the score was 151–200.<sup>[9]</sup>
- II. **The Motivated Strategies for Learning Questionnaire (MSLQ)** is a self-administered tool for evaluating college students' motivational orientations and use of various LS. The MSLQ is founded on a broad cognitive understanding of motivation and learning techniques. The MSLQ has two sections: a motivation section (31 items) and a learning techniques section (50 items). Students use a 7-point Likert scale to score themselves, ranging from "not at all true of me" to "very true of me."<sup>[17]</sup>
- III. **Emotional intelligence questionnaire** is a self-assessment questionnaire that demonstrates thinking about EI competencies such as self-awareness, managing emotions, motivating oneself, empathy, and social skills. The score ranges from 1 to 5, with 1 indicating that it does not apply to you at all, for a total score of 35–50 indicating that this area is a strength for you, 18–34 indicating that paying attention to where you feel is required, and 10–17 indicating an immediate development priority.<sup>[18]</sup>
  - The work was conducted through two steps:
    - 1 **Validation and translation of the questionnaire:** The questionnaires were adapted according to the process of cross-cultural adaptation accepted internationally and included five stages<sup>[19]</sup>: (1) translation of the original language into Arabic by two bilingual translators, (2) the translators and three professors discussed the inconsistencies in the translations, (3) another two translators translated the questionnaire back into the original language for validity confirmation, (4) the authors and translators reviewed the final translations and then developed a pre-final version of the questionnaire, and (5) a pilot was conducted on 50 students of various grades to assess the reactivity and whether the questions would be comprehensible and presented consistently or not. Internal consistency for the final version was tested, and Cronbach's alpha coefficient was calculated and was 0.91 for the DREEM scale, 0.93 for the MSLQ, and 0.86 for the EI questionnaire. The survey was conducted in separate sessions to all classes from second to final year.
    - 2 **Data collection:** Students were requested to complete self-administered questionnaires. The students answered questions about age, sex, residence (rural or urban), income (the answer here varies individually and is subjectively evaluated between not enough, enough, and more than enough), stage of education (clinical or preclinical), and type of education (a traditional education means six years' education + one year's training, whereas integrated education means five years' education + two years' training). After receiving valid written approval from the controller of the exam and maintaining complete anonymity, each student's academic record was collected from the examination department. Students with a cumulative percentage of 65% or higher in all professional examinations and all exams passed on the first trial were classified as high achievers. Lower achievers were those who scored less than 65% or failed to pass the professional examinations on their first attempt in any subject.

### Ethical considerations

Approval of Institutional Review Boards (IRB) (ID: COM 2104) was obtained. Participants' consent was obtained through an informed consent process in which each participant was informed of all aspects of the study and had the option to withdraw at any time. The main participants were committed to the ethical principles outlined in the "Helsinki Declaration."

### Statistical analysis

SPSS statistical program version 22 was used to analyze the results (SPSS Inc. IBM SPSS statistics for Windows, version 22.0, Armonk, NY: IBM Corp.). Descriptive statistics were expressed in terms of number (No), percentage (%), mean ( $\bar{x}$ ), and standard deviation. For parametric data, an independent sample t-test and Analysis of variance tests were used, whereas for nonparametric data, the Mann-Whitney test and Kruskal-Wallis tests were applied. The predictors between the dependent and independent variables were identified using multiple regression analysis and pathway analysis. A *P* value of less than 0.0 was set.

## Results

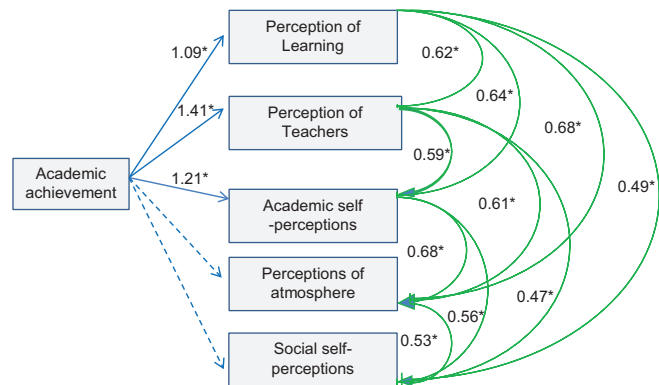
In this study, 3384 students were recruited. Females represented 63.5% of the study sample with an overall mean age of  $21.42 \pm 1.61$  years. Among the students, 52.2% were rural residents and 88.0% of the students had enough income. Regarding the education system, 28.4% of the students were enrolled in the traditional system, whereas 71.6% of them were enrolled in the integrated system. In the previous year, scores among students were 41.1% very good, 36.2% excellent, 16.7% good, 4.9% passed, and 1.0% failed [Table 1].

DREEM scale results on total number of students were more positive than negative ( $101.82 \pm 20.37$ ); Student's perception of learning ( $23.79 \pm 5.46$ : learning is shown negatively), Student's perceptions of teachers ( $22.88 \pm 5.16$ : Moving in the right direction), Student's academic self-perceptions ( $15.89 \pm 4.42$ : many negative aspects), Student's perceptions of atmosphere ( $24.74 \pm 5.83$ : A more positive atmosphere), Student's social self-perceptions ( $14.77 \pm 3.77$ : Not very bad).

Educational environment and academic achievement [Figure 1]: Three components of the educational environment (DREEM scale) were significantly positive predictors of students' high academic achievement (perceptions of learning:  $\beta = 1.10$ , CI95%: 0.30–1.89, *P* = 0.007; perceptions of teachers:  $\beta = 1.41$ , CI95%: 0.57–2.25, *P* = 0.001; academic self-perceptions:  $\beta = 1.21$ , CI95%: 0.23–2.19, *P* = 0.015).

**Table 1: Baseline characteristics of the participants (n=3384)**

Variables	No	%.
Age		
Mean±SD		21.42±1.61
Gender		
Male	1234	36.5
Female	2150	63.5
Residence		
Urban	1616	47.8
Rural	1768	52.2
Income level		
Enough	2977	88.0
Not enough	407	12.0
Education system		
Traditional	960	28.4
Integrated	2424	71.6
Previous year scholastic score		
Failed	35	1.0
Passed	167	4.9
Good	566	16.7
Very good	1392	41.1
Excellent	1224	36.2
Private courses		
Yes	1477	43.6
No	1906	56.4



**Figure 1:** Path diagram of the model used for the whole group of subjects for academic achievement scores and the educational environment (DREEM scale)

Details of motivation and learning strategies and emotional intelligence components were demonstrated in Figure 2 as predictors of academic achievement, in the following order: resource strategy component of learning strategies ( $\beta = 11.69$ :CI95%: 5.82-17.65, *P* = 0.001), value component of motivation ( $\beta = 6.77$ :CI95%: 2.22-9.15, *P* = 0.001), and empathy as a component of emotional intelligence ( $\beta = 2.32$ :CI95%:1.18-3.45, *P* < 0.001).

Linear regression using path analysis [Figure 3] was followed to study the predictors of academic achievement collectively and revealed that motivation was a significantly positive predictor of academic achievement ( $\beta = 2.68$ , CI95%:2.35–3.05, *P* < 0.001),

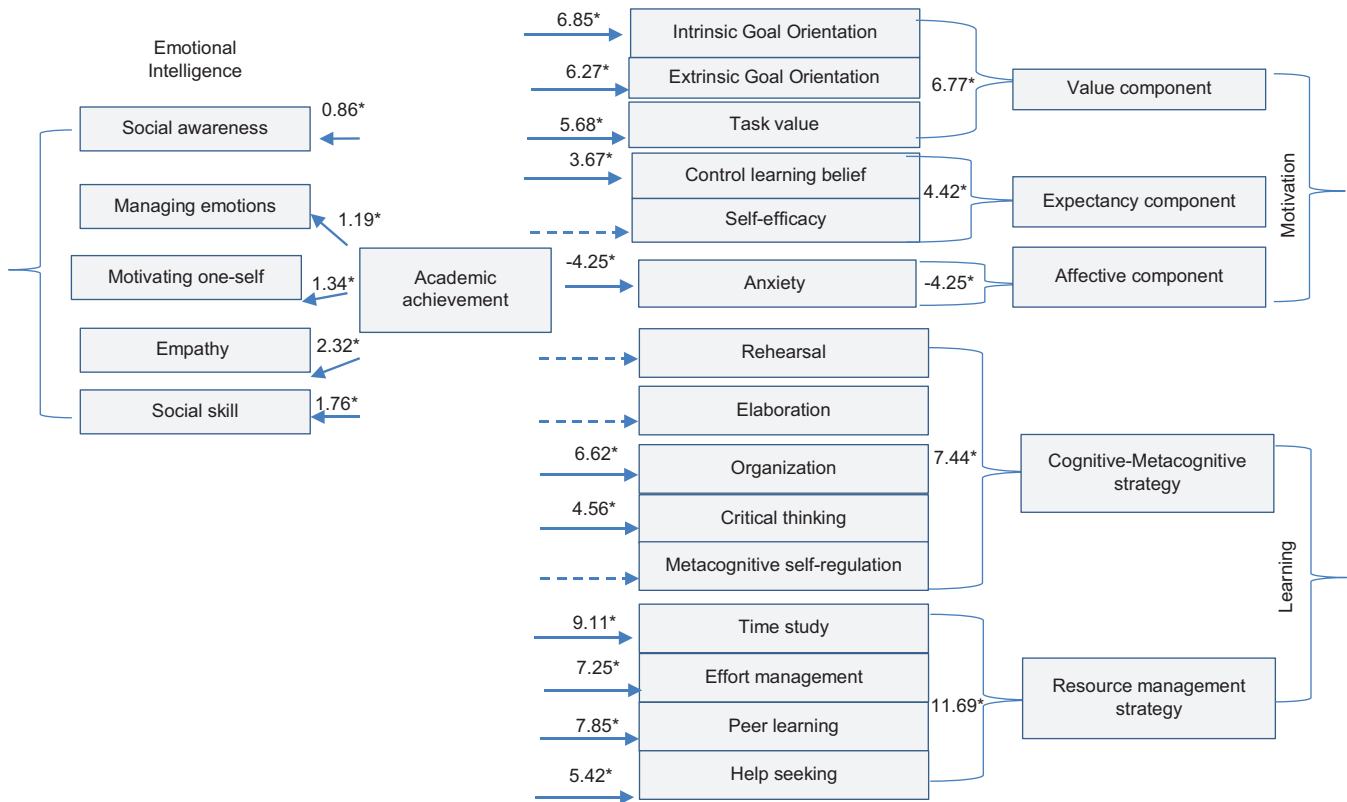


Figure 2: Path diagram of the model used for the whole group of subjects for academic achievement scores and Motivated Strategies for Learning and Emotional Intelligence

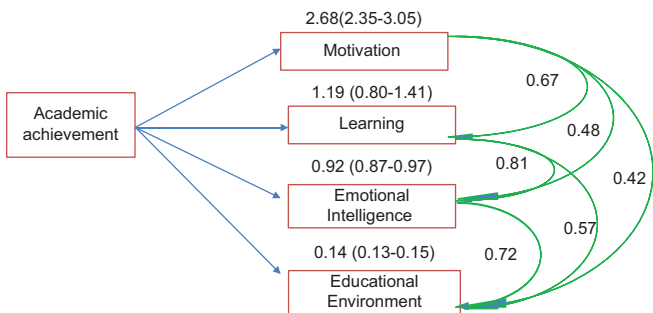


Figure 3: Path diagram of the model used for the whole group of subjects for total scores of academic achievement, educational environment (DREEM scale), and Motivated Strategies for Learning and Emotional Intelligence

followed by learning ( $\beta = 1.09$ , CI95%:0.80–1.41,  $P < 0.001$ ), EI ( $\beta = 0.92$ , CI95%:0.87–0.97,  $P < 0.001$ ), and the educational environment ( $\beta = 0.14$ , CI95%:0.13–0.15,  $P < 0.001$ ).

The students in integrated system showed significantly higher scores compared with those in the traditional system as regards mean score of DREEM components (perceptions of learning and perceptions of the atmosphere) (0.006 and  $<0.001$ ), respectively, mean score of motivation components (Value Components, Expectancy Components) except affective components was significantly higher among students with the integrated system ( $P = <0.001$ , 0.005, and 0.001, respectively), mean score of learning strategies (Cognitive

and Meta-cognitive Strategies and Resource Management Strategies) ( $P < 0.001$ , 0.002, and 0.001), respectively, and mean score of EI ( $P = 0.012$ ).

The preclinical stage reported significantly higher scores than the clinical stage as regards the mean scores of DREEM components (perceptions of learning, perceptions of teachers, and perceptions of the atmosphere) ( $P = 0.019$ , 0.039, and 0.001) respectively, mean scores of motivation components (Value Components, Expectancy Components) ( $P = 0.004$  and 0.04), respectively, whereas affective components were significantly higher among students in the clinical stage than in the preclinical stage ( $P = 0.022$ ) and mean scores of learning strategies (Cognitive and Meta-cognitive Strategies and Resource Management Strategies) ( $P = 0.001$ , 0.001, and 0.002), respectively, and Mean scores of EI components ( $P < 0.001$ ) [Table 2].

Females showed higher scores than males as regards mean DREEM score, mean motivation score, mean Resource Management Strategies ( $P = 0.039$ ) and mean EI ( $P = 0.028$ ). High academic achievers showed higher scores as regards mean DREEM score along with mean score of its components ( $P < 0.05$ ), mean score for Value Components ( $p < 0.001$ ), but affective components were significantly higher in low academic achievers ( $p = 0.021$ ), mean learning score and its Resource Management Strategies ( $p = 0.044$  and  $<0.001$ ), respectively, and mean EI

**Table 2: Distribution of DREEM scale, motivated strategies for learning questionnaire manual, and emotional intelligence questionnaire regarding education system and education stage of the studied group**

	Education system		Effect size (CI95%)	P	Education stage		Effect size (CI95%)	P
	Integrated (n=960)	Traditional (n=2424)			Pre-clinical (n=1519)	Clinical (n=1865)		
	Mean±SD	Mean±SD	Mean±SD	Mean±SD				
DEEM scale	103.37±19.30	101.20±20.75	0.11 (0.03-0.18)	0.004*	102.67±19.76	101.12±20.83	0.07 (0.01-0.14)	0.027*
Perceptions of learning	24.20±5.43	23.62±5.47	0.11 (0.03-0.18)	0.006*	24.03±5.34	23.59±5.56	0.08 (0.01-0.15)	0.019*
Perceptions of teachers	23.0±4.49	22.81±5.41	0.03 (-0.03-0.11)	0.144	23.08±4.99	22.72±5.29	0.07 (0.02-0.13)	0.039*
Academic self-perceptions	16.0±4.42	15.82±4.42	0.04 (-0.03-0.11)	0.104	15.94±4.32	15.86±4.51	0.02 (-0.01-0.08)	0.628
Perceptions of atmosphere	25.17±5.64	24.19±5.88	0.17 (0.09-0.24)	<0.001*	24.82±5.71	24.18±5.90	0.11 (0.04-0.18)	0.001*
Social self-perceptions	14.82±3.37	14.74±3.77	0.02 (-0.05-0.09)	0.590	14.78±3.80	14.76±3.75	0.01 (-0.06-0.07)	0.684
Motivation	4.92±0.37	4.87±0.42	0.12 (0.04-0.19)	<0.001*	4.89±0.40	4.87±0.41	0.05 (-0.01-0.11)	0.151
Value Components	5.05±0.98	4.95±1.17	0.09 (0.02-0.17)	0.005*	5.03±1.06	4.92±1.16	0.10 (0.02-0.16)	0.004*
Expectancy components	5.0±0.97	4.87±1.04	0.13 (0.05-0.20)	0.001*	4.95±1.0	4.88±1.04	0.07 (0.01-0.13)	0.042*
Affective components	4.70±1.05	4.77±1.20	-0.06 (-0.13-0.04)	0.131	4.70±1.12	4.79±1.18	-0.07 (-0.14-0.1)	0.022*
Learning	4.79±0.59	4.70±0.70	0.14 (0.05-0.20)	<0.001*	4.76±0.83	4.69±0.71	0.09 (0.02-0.15)	0.001*
Cognitive and Metacognitive Strategies	4.88±0.64	4.80±0.75	0.11 (0.03-0.18)	0.002*	4.87±0.67	4.79±0.75	0.11 (0.04-0.18)	0.001*
Resource Management Strategies	4.69±0.67	4.59±0.76	0.14 (0.06-0.21)	0.001*	4.66±0.70	4.59±0.77	0.10 (0.02-0.16)	0.002*
Emotional intelligence	36.77±3.77	36.40±4.29	0.09 (0.01-0.16)	0.012*	36.75±4.01	36.30±4.26	-0.11 (-0.17-0.04)	0.002*
Self-awareness	37.92±4.96	37.35±5.28	0.11 (0.03-0.18)	0.003*	37.87±5.11	37.22±5.25	0.13 (0.06-0.19)	<0.001*
Managing emotions	35.57±5.04	35.14±5.56	0.08 (0.01-0.15)	0.032*	35.55±5.28	35.03±5.53	0.09 (0.02-0.16)	0.006*
Motivating one-self	35.25±4.49	34.77±4.97	0.10 (0.02-0.17)	0.006*	35.19±4.72	34.67±4.93	0.11 (0.04-0.17)	0.002*
Empathy	37.10±3.50	36.86±3.94	0.06 (-0.01-0.13)	0.087	37.09±3.68	36.80±3.93	0.07 (0.01-0.14)	0.026*
Social skill	38.02±3.81	37.86±4.34	0.03 (-0.03-0.11)	0.278	38.06±4.07	37.77±4.30	0.06 (0.01-0.13)	0.044*

\*significant, Cohen's d was calculated as effect size for t test CI95%: Confidence interval at level of 95%

along with mean score of its components (Self-awareness, Managing emotions, Empathy, and social skills) except Motivating oneself ( $p = 0.001, 0.041, 0.001, <0.001,$  and  $<0.001$ ), respectively [Table 3].

### Discussion

The present study revealed that the educational environment was a significant predictor of academic achievement; also, the results showed a significant difference between high and low academic achievers. These findings agree with the findings of other studies.<sup>[20-23]</sup> This could be explained by observing, that students who excelled academically were more self-directed with positive environmental perceptions. Other studies had found no link between students' evaluations of the learning environment and their academic success.<sup>[22,24,25]</sup>

The key point in this study is exploring the relationship between the type of education system (traditional and integrated) and perception of education environment, EI, motivation, and LS. The result indicated that students in the integrated system have significantly higher scores for the total DREEM score along with the mean score of two of its components (perceptions of learning and perceptions of the atmosphere) compared with traditional system students. This finding agrees with previous studies.<sup>[26,27]</sup> The mean of motivation, learning, and EI scores were

significantly higher among students in the integrated system. These findings are particularly interesting because they reflect the advantages of the integrated, student-centered system. Student-centered education begins with changing the perceptions of the learning environment by adopting elements of problem-based and community-based approaches encouraging the students to be more responsible. However, in the traditional system, the curriculum is teacher-centered without choices or selectivity in modules.

The preclinical stage students showed significantly higher DREEM scores. This finding was consistent with many studies.<sup>[28-30]</sup> This might be explained by the fact that first-year students are not exposed to all the areas and are not too stressed by the study. Conversely, some studies found a better perception of the learning environment among students in their senior years.<sup>[20,21]</sup> This indicates that as the students' progress further in the academic years, they become more autonomous, mature, and self-directed and have more academic skills. These variables affect their learning outcomes and perception of the educational climate. Other studies showed no difference.<sup>[31-34]</sup>

Students in the preclinical stage had significantly higher scores for total EI and its subscales. These findings disagree with Austin *et al.*<sup>[35]</sup> and Haralur *et al.*<sup>[36]</sup> in the United States, who reported a significant association between EI and performance at the clinical stage.

**Table 3: Distribution of DREEM scale, motivated strategies for learning questionnaire manual, and emotional intelligence questionnaire regarding sex and scholastic achievement of the studied group**

	Sex		Effect size (CI95%)	P	Scholastic Achievement		Effect size (CI95%)	P
	Male (n=1234)	Female (n=2150)			Low (n=766)	High (n=2618)		
	Mean±SD	Mean±SD			Mean±SD	Mean±SD		
DEEM scale	100.26±17.47	102.71±20.38	0.12 (0.05-0.19)	0.001*	99.20±19.35	102.58±20.60	0.17 (0.08-0.25)	<0.001*
Perceptions of learning	23.40±5.38	24.01±5.50	0.11 (0.04-0.18)	0.002*	23.21±5.14	23.96±5.54	0.14 (0.05-0.22)	0.001*
Perceptions of learning	22.50±4.86	23.10±5.32	0.12 (0.05-0.18)	0.001*	22.43±4.99	23.01±5.20	0.11 (0.03-0.19)	0.006*
Academic self-perceptions	15.66±4.36	16.03±4.46	0.08 (0.01-0.15)	0.017*	15.47±4.29	16.02±4.46	0.13 (0.04-0.21)	0.003*
Perceptions of atmosphere	24.20±5.67	24.62±5.91	0.07 (0.0-0.14)	0.043*	23.92±5.80	24.63±5.82	0.12 (0.04-0.20)	0.003*
Social self-perceptions	14.49±3.73	14.92±3.78	0.11 (0.04-0.18)	0.001*	14.15±3.67	14.95±3.78	0.21 (0.13-0.29)	<0.001*
Motivation	4.91±1.13	5.01±1.11	0.09 (0.01-0.16)	0.001*	4.86±0.40	4.89±0.41	0.07 (-0.01-0.15)	0.021*
Value Components	4.86±1.03	4.94±1.02	0.08 (0.01-0.15)	0.018*	4.84±1.11	5.02±1.12	0.16 (0.08-0.24)	<0.001*
Expectancy components	4.76±1.16	4.74±1.15	0.02 (-0.08-0.05)	0.025*	4.89±1.03	4.92±1.02	0.02 (-0.05-0.11)	0.571
Affective components	4.85±0.41	4.89±0.40	0.10 (0.03-0.17)	0.554	4.83±1.12	4.73±1.17	-0.08 (-0.16-0.01)	0.021*
Learning	4.69±0.70	4.74±0.66	0.07 (0.0-0.14)	0.078	4.68±0.70	4.73±0.67	0.07 (-0.1-0.15)	0.044*
Cognitive and Metacognitive Strategies	4.80±0.72	4.84±0.72	0.05 (-0.01-0.12)	0.229	4.83±0.74	4.82±0.71	0.01 (-0.09-0.07)	0.961
Resource Management Strategies	4.59±0.75	4.64±0.72	0.06 (0.0-0.14)	0.039*	4.53±0.75	4.65±0.73	0.16 (0.08-0.24)	<0.001*
Emotional intelligence	36.31±4.20	36.61±4.13	0.07 (0.0-0.14)	0.042*	36.08±4.17	36.63±4.14	0.13 (0.05-0.21)	0.001*
Self-awareness	37.41±5.24	37.57±5.17	0.03 (-0.04-0.10)	0.395	37.18±5.01	37.61±5.25	0.08 (0.02-0.16)	0.041*
Managing emotions	34.99±5.37	35.42±4.45	0.09 (0.01-0.16)	0.028*	34.70±5.16	35.43±5.49	0.13 (0.05-0.21)	0.001*
Motivating one-self	34.85±4.96	34.93±4.77	0.01 (-0.50-0.08)	0.655	34.83±4.82	34.93±4.85	0.02 (-0.06-0.11)	0.614
Empathy	36.71±3.72	37.06±3.88	0.08 (0.01-0.15)	0.013*	36.40±3.63	37.09±3.87	0.18 (0.10-0.26)	<0.001*
Social skill	37.58±4.04	38.09±4.28	0.12 (0.05-0.19)	0.001*	37.30±3.98	38.08±4.24	0.19 (0.10-0.27)	<0.001*

\*significant, Cohen's d was calculated as effect size for t test CI95%: Confidence interval at level of 95%

However, Altwijri *et al.*,<sup>[37]</sup> and Wijekoon *et al.*,<sup>[38]</sup> found that total EI scores did not differ significantly between students at the clinical and preclinical stages.

The present results showed that students in the preclinical stage have significantly higher scores for motivation components and LS. This result was opposite to Orsinia *al.*, as their results showed positive and significant differences in relative autonomous motivation when transitioning from a preclinical to a clinical environment.<sup>[39]</sup>

The results revealed that academic achievement was positively associated with EI. This finding agrees with previous studies.<sup>[38,40,41]</sup> This finding could be explained by that students with high EI tend to display strong socialization skills and strong motivation to achieve their goals,<sup>[42]</sup> whereas lower EI is closely associated with poor cognitive abilities (e.g., concentration, memory, and retrieval of information) and ineffective communication skills.<sup>[43]</sup>

There was a significant difference between high and low academic achievers regarding the value components, affective component, and the control learning belief of the expectancy component. This was, to some extent, in line with a study carried out in China and found a strong link between students' goals and their academic achievement.<sup>[44]</sup> This could be attributed to the fact that

student motivation leads them to believe that tasks are worthwhile and valuable, causing them to use more cognitive and monitoring strategies and to achieve their target.

Also high and low academic achievers showed a significant difference regarding all resource management strategy, organization, and critical thinking. Several prior studies have mainly supported this finding.<sup>[45,46]</sup> Conversely, other findings are contradictory and reported that self-efficacy and meta-cognitive strategies were the most powerful factors of academic achievement,<sup>[47,48]</sup> whereas self-regulating LS showed no significant difference in, for example, an Iranian study.<sup>[49]</sup>

In this study, females' perception of the learning environment was more positive than that of males. This agrees with previous studies<sup>[24,50]</sup> but contradicts others.<sup>[21]</sup> Females' higher results could be due to differences in learning methods and how they perceived the learning environment.<sup>[39]</sup> Also, females focus on the quality of teaching and the importance of participating in class.

Emotional intelligence scores were significantly higher among females, which is consistent with studies undertaken in both the United Kingdom and India<sup>[51,52]</sup> but disagrees with studies carried out in Saudi Arabia, Pakistan, and Sri Lanka.<sup>[38,42]</sup>

For motivation, females tended to achieve high scores in terms of value components and expectancy components of motivation and resource management LS. Females showed more effort regulation and a greater appreciation of peer learning.<sup>[32]</sup> Sivrikayain 2019 supported males on the account of females.<sup>[53]</sup> Charles and Harriett supported females in extrinsic goal orientation, control for learning beliefs, self-efficacy, and test anxiety, whereas they supported males in intrinsic goal orientation and task value.<sup>[35]</sup>

### Strengths and limitations

The present study had many strong points when compared with previous studies. One of these is being the first Egyptian study conducted on this large sample size that included students from more than one Egyptian university. It is also the first study to use three assessment scales to assess the interaction between the impact of the educational environment, motivational LS, and EI on medical students' academic achievement. The present study's use of self-reporting scales was a limitation because respondents might have refused to answer the questions honestly. These constraints were partially overcome by properly communicating with the participants and explaining that their participation was optional and that their responses would be kept confidential.

### Conclusion

The study's findings have implications for medical educators trying to understand the personal factors that influence learning and performance in medical school. Students' motivation was the highly significant predictor of academic achievement followed by learning, emotional intelligence, and educational environment. Perception of the learning environment had improved because of the integrated student-centered system, which fosters motivation and emotional intelligence. To improve learners' EI, optimal learning, and educational outcomes, the EI components can be taught and fostered.

### Declarations

#### Ethics approval and consent to participate

The current study was carried out following the Declaration of Helsinki and commenced after obtaining approval from the Research Ethical committee of Menoufia Faculty of Medicine, Menoufia University (ID: 4/2021COM). An informed consent were taken in which each participant had been informed of all aspects of the study and had the right to give up as he wanted.

#### Consent for publication

Not applicable as informed consents were waived by IRB committees.

### Availability of data and materials

The dataset analyzed during the current study are available from authors upon justified request.

### Authors' contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work

### Acknowledgements

All thanks to medical students for participation in the study and Asmaa Sharafeldin and Angham Soliman for helping data collection.

### Financial support and sponsorship

Nil.

### Conflicts of interest

There are no conflicts of interest.

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