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Educational Article

Educational environment and psychological distress of medical students: The role of a deep learning approach

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الملخص

أهداف البحث: اتفقت الدراسات على أن البيئة التعليمية المثلى هي الجانب الحيوي للتعلم الفاعل وتعزيز رفاهية الطلبة. على العكس، تذكر التقارير أن التدريب الطبي هو بيئة دون المستوى الأمثل، وبالتالي تؤثر سلبا على تعلم ورفاهية الطلبة. تهدف هذه الدراسة لاستكشاف العلاقات المتبادلة بين بيئة التعلم، وأساليب التعلم والأضرار النفسية على طلبة الطب.

طرق البحث: أجريت هذه الدراسة المقطعية على ٦٥٦ من طلبة الطب. استخدم مقياس "داندي" الجاهز للبيئة التعليمية، قائمة أساليب التعلم و٢١ عنصرا من مقياس الاكتئاب والقلق والتوتر لقياس البيئة التعليمية، وأساليب التعلم والأضرار النفسية، على التوالي. تم تنفيذ نموذج معادلة هيكلية من خلال تحليل برمجيات هيكلة وقتية.

النتائج: أظهرت النتائج أن نموذج الهيكلة المقترحة يعد نموذجا جيدا ومناسبا (مؤشر الجودة المناسب =٠.٩٢٠، وجذر متوسط المربع التقريبي =٠.٠٤٨، ومؤشر تاكر-لويس =٠.٩٥٣، ومؤشر المقارنة المناسب =٠.٩٦٠، ومؤشر نورمد المناسب =٠.٩٢٤، و=Chi^2/df.٠٢٠ . كما تبين أن أثر التعلم العميق على الأضرار النفسية كان بواسطة البيئة التعليمية كليا، بينما لم تدعم قياساتنا آثار استراتيجيات التعلم الأخرى.

الاستنتاجات: إن للبيئة التعليمية الإيجابية تأثيرات مباشرة وإيجابية على الصحة النفسية لطلبة الطب. ولأساليب التعلم الاستراتيجية والعميقة تأثيرات إيجابية على البيئة التعليمية الملموسة، بينما كانت الآثار الإيجابية لأساليب التعلم العميقة غير مباشرة على الصحة النفسية. كما أن تحسين البيئة التعليمية وتعزيز التعلم العميق لطلبة الطب سيحسن الصحة النفسية أثناء التدريب الطبي.

الكلمات المفتاحية: البيئة التعليمية؛ الصحة النفسية؛ أسلوب التعلم السطحي؛ أسلوب العلم الاستراتيجي؛ أسلوب التعلم العميق

Abstract

Objectives: Studies concur that an optimal learning environment is a vital aspect for effective learning and for enhancing students' well-being. Conversely, medical training is reported to be a suboptimal environment, thereby compromising students' learning and well-being. This study aimed to explore the interrelations of the learning environment, learning approaches and psychological distress among medical students.

Materials and Methods: A cross-sectional study was conducted on 656 medical students. The Dundee Ready Educational Environment Measurement, Learning Approaches inventory and 21-item Depression Anxiety Stress Scale were administered to measure the educational environment, learning approaches and psychological distress, respectively. Structural equation modelling was performed by Analysis of Moment Structure software.

Results: The results showed that the proposed structural model had good model fit (Goodness of Fit Index (GFI) = 0.920, Root Mean Square of Error Approximation (RMSEA) = 0.048, Tucker–Lewis Index (TLI) = 0.953, Comparative Fit Index (CFI) = 0.960, Normed Fit Index (NFI) = 0.924, Chi^2/df = 2.020). The effect of deep learning on psychological distress was fully moderated by the educational environment, while the effects of other learning strategies on psychological distress were not supported in our analysis.

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Conclusions: A positive educational environment has direct and positive influences on the psychological health of medical students. Strategic and deep learning approaches have positive influences on the perceived educational environment, but only the deep learning approach has indirect positive effects on psychological health. Improving the educational environment and promoting deep learning approaches for medical students will improve their psychological health during medical training.

Keywords: Deep learning approach; Educational environment; Psychological health; Surface learning approach; Strategic learning approach

Introduction

Several studies have reported that the prevalence of psychological distress among medical students during medical training is higher than that of the general population.[1–3] In fact, several studies have demonstrated that prior to medical training, the prevalence of psychological distress is similar to that of the general population.[1–4] In addition, a comparative study on psychological distress between first degree students of 15 courses revealed that medicine and health sciences students had the highest stress score, followed by engineering and veterinary medicine, whereas the lowest stress scores were scored by students of forestry, educational studies and environmental studies.[5] These results indicate that medical training does not provide an optimal learning environment to medical students' psychological health with respect to learning.[6–12] A recent study reported that areas of educational concern increased as medical training progressed[13] – which indicated that the learning environment was deteriorating as the medical training progressed. Thus far, one study reported that nursing students who perceived the educational environment positively had high academic achievement.[14] However, to the best of the author's knowledge, little is known about the relationship between the educational environment and psychological health in a medical education setting. From that notion, this research examines the effect of the educational environment on psychological health in a medical education context. Thus, the first hypothesis of this paper is: *H1* – the perceived educational environment has a direct effect on the psychological distress of medical students.

Three different learning approaches are proposed in the literature – surface, strategic and deep learning approaches.[15,16] The existing different characteristic of these three approaches are depend on the motive (i.e., intention) and strategy (i.e., process) of learners while learning.[15,16] Deep learners usually learn through understanding the subjects based on evidence, where their intention is to seek their own meaning of the subjects, to enhance their understanding and produce mastery.[15–17] Strategic learners generally learn through systematic and smart study, where they are bound to the syllabus of the course and their intention is to attain the highest marks that are possible.[15–17] Surface learners commonly learn through memorizing facts, learn due to fear of failure, and focus on making a minimal effort to pass the examination.[15–17] To date, little is known about the relationship between the different learning approaches and psychological health. Thus far, one study reported that the surface learning approach positively correlated with the perceived stress scores – when the surface learning approach scores go up, the perceived stress scores go up as well.[18] The study did not find any significant correlation between other learning approaches and perceived stress scores.[18] From that notion, three hypotheses are identified, which are: *H2* – the surface learning approach has a direct effect on psychological distress; *H3* – the strategic learning approach has a direct effect on psychological distress; and *H4* – the deep learning approach has a direct effect on psychological distress.

To date, limited studies have reported about interrelations between learning approaches and the educational environment. One study has suggested that students' learning approaches are influenced by the learning environment[14] that is constructed by the attributes of the teachers, atmosphere, academic self-perception, social self-perception and teaching and learning.[19] Pimparyon et al. (2000) reported that deep and surface approaches to learning had a positive correlation with several aspects of the learning environment – the deep learning approach had a stronger correlation with the learning environment than the surface learning approach. These results suggest that students with different learning approaches perceive the educational environment differently. As a result of these findings, this study proposes another three hypotheses: *H5* – the surface learning approach has a direct effect on the perceived educational environment; *H6* – the strategic learning approach has a direct effect on the perceived educational environment; and *H7* – the deep learning approach has a direct effect on the perceived educational environment.

In addition to the already mentioned facts, the author noted that none of the papers reported on the mediation effects of the educational environment on the relationships between the learning approaches and psychological distress. Therefore, this study proposes an additional three hypotheses: *H8* – the surface learning approach has an indirect effect on psychological distress that is mediated by the educational environment; *H9* – the strategic learning approach has an indirect effect on psychological distress that was mediated by the educational environment; and *H10* – the deep learning approach has an indirect effect on psychological distress that was mediated by the educational environment.

From a review of the available literature, a model of the interrelations between the learning approaches, educational environment and psychological distress is proposed and is shown in Figure 1. This model was empirically tested following the methodological procedures below.

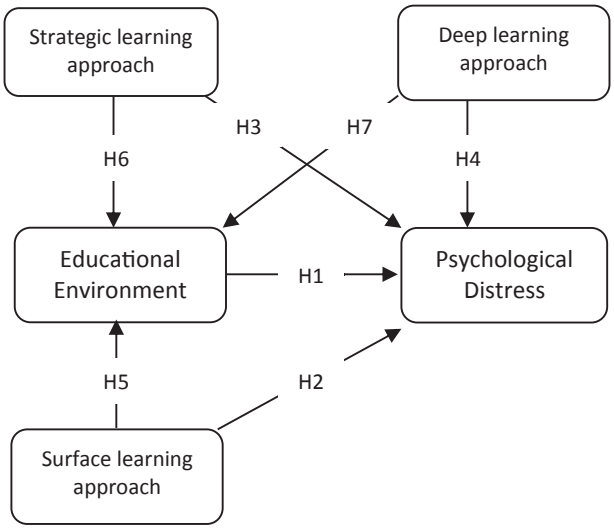

Figure 1: The proposed model interrelations between learning approaches, the educational environment and psychological distress.

Materials and Methods

A cross-sectional study was conducted, and the purposive sampling method was applied. The researcher selected first, third and fifth year medical students (i.e., a total of 656 individuals) in the School of Medical Sciences, Universiti Sains Malaysia, as study subjects. The first, third and fifth year of study were selected because they will represent the different phases of medical training, which are pre-clinical, paraclinical and clinical. Ethical approval was obtained from the institution prior to the start of the study.

Data was collected by a guided self-administered questionnaire during a face-to-face session in a hallway. Completion of the Dundee Ready Educational Environment Measurement (DREEM), Learning Approaches Inventory (LA-i) and 21-item Depression Anxiety Stress Scale (DASS-21) was voluntary, and the medical students were informed that this study would not affect their progress in their medical course of study. The forms were immediately collected after they were completely filled in.

The DREEM was developed as a tool to measure the educational climate[19,20] and was claimed to be a 'cultural-free' instrument.[20] This tool has 50 items that assess five facets of the learning environment based on students' perceptions, which include students' perception of teaching (SPoT), students' perception of learning (SPoL), students' academic self-perception (SASP), students' social self-perception (SSSP) and students' perception of atmosphere (SPoA).[19,21] Each item is rated based on five Likert scales that range between 0 and 4 (0 = strongly disagree, 1 = disagree, 2 = unsure, 3 = agree and 4 = strongly agree). It has been translated into many languages, and the internal consistency coefficients (i.e., Cronbach's alpha) range from 0.89 to 0.93.[22–29] The original version of DREEM was employed in this study.

Psychological distress was measured by DASS-21, which measures the depression, anxiety and stress levels - a high score on each subscale indicates poor mental health.[30–33] Its validity and reliability among student samples have been well established.[33,34] The internal consistency coefficients of depression, anxiety and stress scales range between 0.81 and 0.97, and they showed discriminative ability to distinguish between psychiatric and non-psychiatric patients.[33] Each statement was rated using 4 Likert scores (0 = Did not apply to me at all, 1 = Applied to me to some degree, or some of the time, 2 = Applied to me to a considerable degree, or a good part of time, 3 = Applied to me very much, or most of the time). The DASS-21 was used in this study because it requires less time to administer, is a well validated and reliable instrument, and is superior and more consistent compared to the full-scale version.[33]

The LA-i was developed based on the surface, strategic and deep learning approaches model.[29,35,36] It has two versions, which are the original version (which consists of 12 statements) and the short version (which consists of nine statements), which represent the characteristics of the three learning approaches.[29,35,36] Each statement was rated using a Likert-type scale (1 = least like you, 2 = in between scores of 1 and 3, 3 = 50% like you, 4 = in between scores of 3 and 5, 5 = most like you) to indicate how close the statement described the respondents' behaviour.[29,35,36] It consists of three subscales (i.e., surface, strategic and deep), and each subscale consists of four statements. The overall Cronbach's alpha value ranges between 0.86 and 0.87, and the subscales' Cronbach's alpha values range from 0.62 to 0.89.[29,35]

A descriptive analysis of the demographic data was performed by Statistical Package for Social Sciences (SPSS) version 20. Confirmatory factor analysis (CFA) was performed to test the measurement model of each latent construct. Structural Equation Modelling (SEM) was performed to examine the interrelations between the observable variables in the proposed model (Figure 1). CFA and SEM were performed by Analysis of Moment Structure (AMOS) software version 19. The latent constructs and proposed model were considered to be fit if all of the goodness-of-fit indices achieve the minimal requirements stated in Table 1.

Results

A total of 442 out of 656 medical students (67.4%) completely responded to the three inventories. The majority were female, Malay and third-year medical students (Table 2).

Measurement model

CFA was performed on each latent construct (as proposed in Figure 1) to test the measurement models prior to SEM. In general, the latent constructs showed model fit as one of the fit indices that achieved the minimum requirement to signify the model fit (Table 3).

Structural equation modelling

The proposed structural model (Figures 1 and 2) had a good model fit to the data (GFI = 0.920, RMSEA = 0.048, TLI = 0.953, CFI = 0.960, NFI = 0.924, Chisq/df = 2.020). The direct effects, indirect effects and total effects of our hypothesized paths are

Table 1: Goodness-of-fit indices that were used to signify the model fit.

Name of category	Name of index	Level of acceptance
Absolute Fit[a]	Root Mean Square of Error Approximation (RMSEA)	Less than 0.08[37]
	Goodness of Fit Index (GFI)	More than 0.9[38]
Incremental Fit[b]	Comparative Fit Index (CFI)	More than 0.9[39]
	Tucker–Lewis Index (TLI)	More than 0.9[40]
	Normed Fit Index (NFI)	More than 0.9[41]
Parsimonious Fit[c]	Chi Square/Degree of Freedom (Chisq/df)	Less than 5[42]

[a] Absolute Fit: Measures overall goodness-of-fit for both the structural and measurement models collectively. This type of measure does not make any comparison to a specified null model (incremental fit measure) or adjust for the number of parameters in the estimated model (parsimonious fit measure).

[b] Incremental Fit: Measures goodness-of-fit that compares the current model to a specified "null" (independence) model to determine the degree of improvement over the null model.

[c] Parsimonious Fit: Measures goodness-of-fit and represents the degree of model fit per estimated coefficient. This measure attempts to correct for any "overfitting" of the model and evaluates the parsimony of the model compared to the goodness-of-fit.

shown in Tables 4–6, respectively. Importantly, the effect of deep learning on psychological distress was fully moderated by the educational environment, while the effects of other learning strategies on psychological distress were not supported in our analysis.

Discussion

The significant findings from this study are that the educational environment has a positive direct effect and it mediated positive effects of deep learning approaches on psychological health of the medical students, and the strategic and deep learning approaches have direct effects on the educational environment. Interestingly, thus far this study is the first to report on direct and indirect relationships of learning approaches, educational environment and psychological distress in the medical education setting. Detailed discussion on each of these important findings follows.

Table 2: Demographic profile.

Variable	Frequency (%)
Sex	
Male	162 (36.7)
Female	280 (63.3)
Ethnic group	
Malay	239 (54.0)
Chinese	158 (35.7)
Indian	38 (8.6)
Others	7 (1.6)
Year of study	
First year	148 (33.5)
Third year	170 (38.5)
Fifth year	124 (28.0)

Findings from this study support that a favourable educational environment directly improves the psychological distress of medical students. Perhaps this finding is consistent with the literature, which highlights that an unfavourable medical training atmosphere leads to a high prevalence of psychological distress[1,3,6–8,43] and eventually leads to unwanted consequences either at the personal level or professional level.[11,12] One of the important implications of this finding is that medical schools should make the effort to regularly evaluate their learning environment for detecting potential areas of concern to enable necessary actions to be taken to improve the quality of the educational climate that is offered to the medical students. Another important message is that medical schools should be aware that a high prevalence of psychological distress among their students might be a signal of an unfavourable educational environment, and thus, proactive effort should be conducted to improve this condition. This study extends the evidence of the important influence of the educational environment on the students' wellbeing in the aspect of psychological health.

The results of this study show significant relationships of strategic and deep learning approaches with the educational environment – the deep learning approach has a stronger relationship than strategic learning. At the same time, the surface learning approach did not have a significant relationship with the educational environment. This result is consistent with a previous study that reported significant correlations between learning approaches and the learning environment.[14] This study provides a different perspective in the sense that strategic and deep learning approaches are important influences on improving the perception of the learning environment. Several insights were learnt from these results, as follows. First, it is contrary with the view on "it is students' perceptions of the learning environment that influences how a student learns, not necessarily the context in itself."[44] This study highlights that students' approaches to learning somehow influence the students' perceptions of the learning environment. Therefore, promoting students to adopt a deep and strategic learning approach might be a useful strategy to ensure that they perceive the learning environment positively. Second, this study found no relationship between the surface learning approach and educational environment, which is contrary to a previous finding that found a significant correlation between the surface learning approach and learning environment.[14] One possible reason for the difference could be due to the different analysis that was performed and the different research tools that were used in the research. Last, medical schools should conduct a faculty development program to train medical educators on skills to promote deep and strategic learning in their students. A good guideline was provided by the Higher Education Academy[45] on actions that could be taken by teachers to promote a deep learning approach among students. Promoting deep and strategic learning approaches in

Table 3: CFA results on each latent construct.

Manifest variables	Latent constructs	λ
Item 1: I'm motivated to learn by a fear of failure.	Surface learning	0.66
Item 2: Most of the time, I'm learning through acquiring information, mechanical memorization without understanding it, and reproducing it on demand in a test.		0.56
Item 3: My learning focus is on the task and material, not on the meanings and purpose.		0.53
Item 4: I'm motivated to learn by a need to achieve high marks.	Strategic learning	0.87
Item 5: I'm motivated to learn by a need to compete with others.		0.82
Item 6: My learning focus depends on what is required by the course.		0.57
Item 7: I'm motivated to learn by an interest in the subject matter	Deep learning	0.84
Item 8: I'm motivated to learn by a need to make sense of things and to interpret knowledge.		0.91
Item 9: During learning, I always make use of analogies and attempt to give the material personal meaning, and sometimes I make use of memorization when the need arises.		0.71
SPoL: Students' perception of learning	Educational environment	0.89
SPoT: Students' perception of teaching		0.78
SASP: Students' academic self-perception		0.87
SPoA: Students' perception of atmosphere		0.91
SSSP: Students' social self-perception		0.73
PD 1: I found it difficult to wind down	Psychological distress	0.70
PD 2: I found myself getting agitated		0.74
PD 3: I was intolerant of anything that kept me from getting on with what I was doing		0.74
PD 4: I experienced trembling (e.g., in the hands)		0.63
PD 5: I felt I was close to panic		0.75
PD 6: I felt scared without any good reason		0.67
PD 7: I found it difficult to work up the initiative to do things		0.68
PD 8: I felt I wasn't worth much as a person		0.76
PD 9: I felt that I was rather touchy		0.71

λ = standardized regression weights.
Learning approaches (surface, strategic and deep): GFI = 0.953, RMSEA = 0.088, TLI = 0.931, CFI = 0.956, NFI = 0.944, Chisq/df = 4.385.
Educational environment (DREEM): GFI = 0.987, RMSEA = 0.096, TLI = 0.976, CFI = 0.993, NFI = 0.991, Chisq/df = 5.093.
Psychological distress (DASS-21): GFI = 0.964, RMSEA = 0.063, TLI = 0.965, CFI = 0.974, NFI = 0.960, Chisq/df = 2.750.

students is a wise strategy to ensure a positive perception of the learning environment, and it will eventually lead to better academic achievement.[14,46–48]

Interestingly, this study shows that none of the learning approaches have a direct effect on psychological distress in the proposed model (Figure 2, Table 5); however, deep learning approaches have an indirect effect on psychological distress as mediated by the educational environment, while surface and strategic learning approaches failed to demonstrate any significant relationship. One important implication of these findings is that promoting strategic deep learning approaches to medical students not only enhances their academic performance but also could lead to improvement in their psychological health. In addition, this study provide evidence to support the important role of deep learning approaches as indirect influences that improve the psychological health of medical students during their training. One possible explanation is that students who know what to learn, when to learn and how to learn will be able to manage academic matters tactfully, which would eventually lead to less academic stress. As reported by a previous study, medical students who perceived academic matters as causing less stress would not be bothered by psychological distress compared to those who perceived academic matters as causing high stress.[7]

Based on the findings, two practical applications can be recommended to medical educators and students to enhance their psychological health. First, medical educators should try their best to promote a deep approach to learning by showing personal interest in the subjects, creating good instructional designs, constructing assessments that promote learning, relating new materials to students' prior knowledge, and providing regular feedback that allows students to learn from misconceptions or mistakes. Second, medical students should try their best to learn through understanding the subjects based on evidence, where their intention is to seek their own meaning on the subjects, to enhance understanding and mastery, and they should regularly ask for feedback from medical educators to monitor their understanding.

It is worthwhile to mention that this study was confined to a medical school, and therefore, any attempt to generalize the findings to other educational settings should be attempted with caution. Perhaps, a multi-centre and multi-field study should be conducted in the future to verify the proposed model. In addition, the sampling that was employed was not the best method due to the vulnerability of a non-probability sampling technique to sampling bias, which could result in inaccuracy of the obtained results. From that notion, future study should employ a probability sampling technique such as systematic random sampling to address this issue in such a

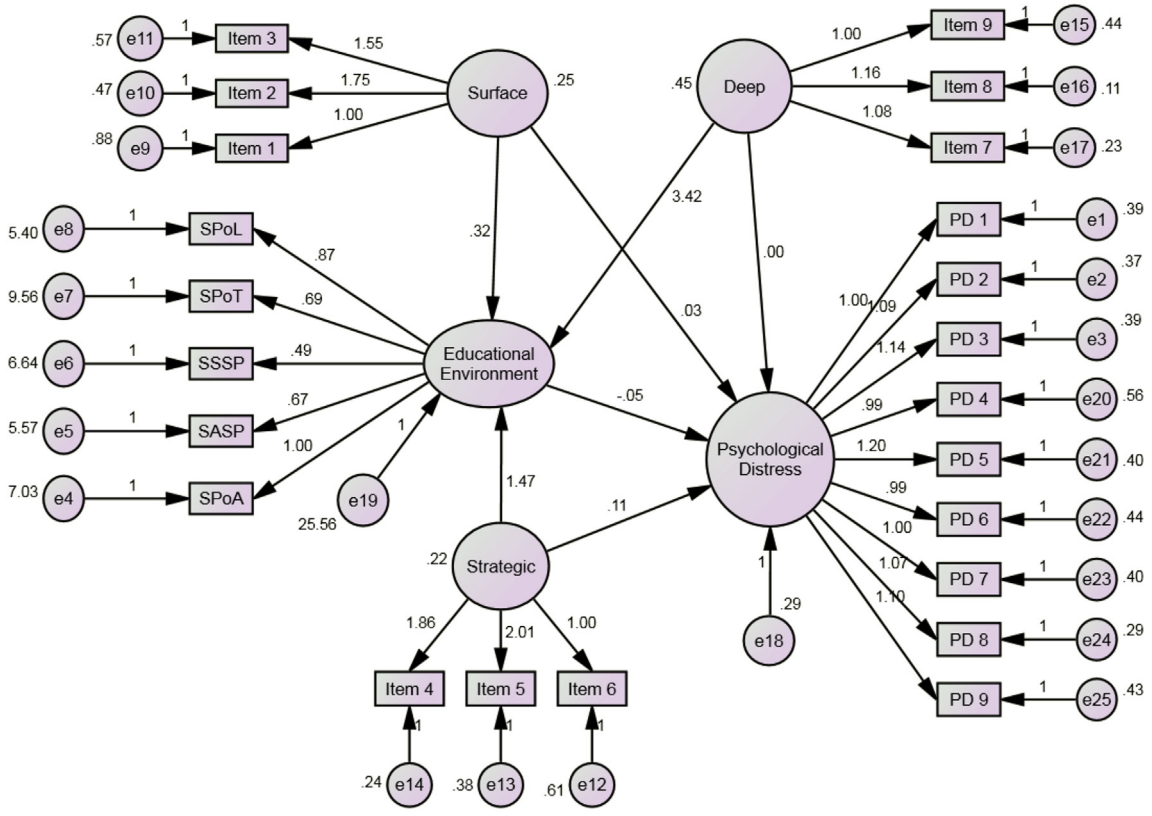

Figure 2: Structural model for the interrelations between learning approaches, educational environment and psychological distress.

Table 4: Estimates of direct effects of surface, strategic and deep learning approaches on psychological distress and the educational environment for the proposed structural model.

Independent variables	Dependent variables	b	SE	*P*-values	Hypotheses
Educational environment	Psychological distress	−0.049	0.006	<0.001	H1: supported
Surface		0.025	0.063	0.690	H2: not supported
Strategic		0.108	0.064	0.094	H3: not supported
Deep		0.001	0.048	0.980	H4: not supported
Surface	Educational environment	0.319	0.582	0.584	H5: not supported
Strategic		1.473	0.593	**0.013**	H6: supported
Deep		3.415	0.438	**< 0.001**	H7: supported

b = unstandardized regression weights; SE = standard error.

Table 5: Estimates of indirect effects of surface, strategic and deep learning approaches on psychological distress via the educational environment for the proposed structural model.

Independent variables	Dependent variables	b	SE	*P*-values	Hypotheses
Surface	Psychological distress	−0.016	0.039	0.791	H8: not supported
Strategic		−0.072	0.049	0.076	H9: not supported
Deep		−0.168	0.040	**0.005**	H10: supported

b = unstandardized regression weights; SE = standard error.

way that more accurate results could be obtained to verify the credentials of the present findings.

Apart from the limitations, this study has several strengths. First, the research variables were measured by validated research tools, and the obtained results supported the measurement model fit. Second, the sample size was adequate for CFA and SEM, and thus, the obtained results are trustworthy for the proposed structural model. Third, the analysis was

Table 6: Estimates of the total effects of surface, strategic and deep learning approaches on psychological distress for the proposed structural model.

Independent variables	Dependent variables	b	SE	*P*-values	Hypotheses
Surface	Psychological distress	0.009	0.107	0.945	H2&H8: not supported
Strategic		0.035	0.106	0.749	H3&H9: not supported
Deep		−0.167	0.060	**0.010**	H4&H10: supported

b = unstandardized regression weights; SE = standard error.

conducted by standard and recommended statistical software, and thus, the obtained results can be trusted and compared with previous studies. Last, as far as the authors are concerned, this study is the first attempt that describes the cause-and-effect relationships between different learning approaches, educational environments and psychological distress by SEM.

Conclusions

A positive educational environment has a direct influence on reducing the psychological distress of medical students. Strategic and deep learning approaches have positive influences on the perceived educational environment. The deep learning approach has indirect positive effects on psychological health. Improving the educational environment and promoting deep learning approaches to medical students will improve their psychological health during medical training.

Conflicts of interests

We have no conflicts of interest to declare.

Authors' contributions

Both of the authors significantly contributed to designing this study, collecting the data, performing the analysis and interpreting the data, preparing the first draft and critically appraising the final draft.

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