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# The Quality of Clinical Education Environment Based on the DREEM Model in Medical Universities of Iran from Students and Professors' Perspective; Systematic Review and Meta-analysis

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## Abstract

**Background:** Appropriate and desirable learning outcomes and achievements are positively associated with desirable aspects of psycho-social learning environments; that is, the best environment gives the best results. The learning environment in medical education is one of the most essential elements that determine the success of an efficient curriculum. Education in hospital departments provides unique opportunities for students to learn through the use of various strategies and different teaching styles. The purpose of this study is a systematic review and meta-analysis regarding the quality of the clinical education environment based on the DREEM model.

**Methods:** This study employed a systematic review and meta-analysis approach. All articles related to the quality of the clinical education environment (educational climate) based on the DREEM model in Iran were searched in 8 databases, collected, and evaluated for quality. Finally, 19 articles were analyzed using Comprehensive Meta-Analysis software.

**Results:** Overall, 190 studies were identified, of which 115 records were screened and 39 were selected and included in the review. Finally, 30 studies comprising 2 psychometric studies of varying quality, provided data on the total score of the DREEM questionnaire and were included in the meta-analysis. The effect measure was the mean of reported scores. The pooled total score was 119.18 out of 200 (95% CI, 112.09-126.26). The highest score was observed in "perception of learning" (28.33, 95% CI, 25.96-30.70), and the lowest score was observed in "social self-perception" (17.52, 95% CI, 16.45-18.74).

**Conclusion:** This is the first systematic review and meta-analysis study in the Islamic Republic of Iran, which has determined the overall situation regarding the quality of the educational climate based on the DREEM model. The results show that the total score is slightly higher than 50%, indicating that social self-perception requires further national planning for improvement.

**Keywords:** Systematic Review, Meta-analysis, Educational Climate, Quality of Education Environment, DREEM Model, Medical University

***Conflicts of Interest:*** *None declared*
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## Introduction

Learning environments are composed of elements that are meaningful together, and the characteristics and qualities of each are effective in shaping different behaviors (1). Appropriate and desirable learning outcomes and achievements are positively associated with desirable aspects of psycho-social learning environments; that is, the

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***↑What is "already known" in this topic:***
The DREEM questionnaire assesses the educational environment in health programs, highlighting strengths and weaknesses.

***→What this article adds:***
This study is the first to assess the clinical education environment in Iran, focusing on perceptions from students and professors in medical sciences universities. The overall score was slightly above 50%, indicating significant room for improvement. The highest score was in "perception of learning," while the lowest were in "social self-perception" and "academic self-perception." The results emphasize the need for effective educational methods and suggest reorienting policies to enhance mental well-being and reduce stress for both professors and students.



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best environment gives the best results (2). The learning environment in medical education is one of the most essential elements that determine the success of an effective curriculum (3). The evidence suggests that an individual's understanding of the learning environment has a significant impact on the educational outcomes of the learning atmosphere (4). It is worth noting that the academic climate is a multidimensional category that affects learners, teachers, staff, and other stakeholders. Additionally, the educational environment has a profound impact on the psychological and social development of students. The academic atmosphere and the quality of teaching and learning are a function of the physical, intellectual, and psychological environment; thus, creating a positive atmosphere provides a strong foundation for student development (5, 6).

Clinical education forms a fundamental and essential part of medical education and is considered the primary source of learning, shaping medical students' professional identity (7). Hospital wards are not always the ideal environment for training; however, a suitable place can be created. Education in hospital departments offers unique opportunities for students to learn through the use of various strategies and diverse teaching styles (8). One of the models used to evaluate the educational environment is the DREEM model, which is employed to diagnose curricular problems, assess the effectiveness of academic changes, and identify the gap between the actual and desired environments (9).

To date, several studies have been conducted on the educational environment using this model in Iran. Evaluation of the academic environment from the perspective of clinical psychology students of the Islamic Azad University of Tehran Medical Sciences (10), a study in Kerman on the views of interns and medical assistants (11) and professors (12) about their learning environment, a survey of Golestan medical students (13), a study on undergraduate students in the operating room of Iran University of Medical Sciences (14), as well as a comparison of different clinical departments in the Faculty of Dentistry from the perspective of specialized assistants (15) and a study on nursing students of Islamic Azad University of Mashhad (16), Birjand (17), Kurdistan (18) and Rafsanjan (19), research from the point of view of medical students and medical faculty members (20), are among published reports. All studies used the DREEM questionnaire as a tool. There are five dimensions in this questionnaire, which include 50 questions in the form of a graded list of five options (Likert) in five areas of learning, professors, students' perception of scientific self-ability, educational atmosphere, and students' perception of their social conditions, and the maximum points are 200 (11, 12).

However, the need for a single, pooled image of the clinical environment climate in Iran remains unanswered. Considering the need to aggregate results and provide evidence-based decision-making for macro-educational policies, this study was conducted to perform a systematic review and meta-analysis of the quality of the clinical education environment (educational climate) based on the DREEM model.

## Methods

### *Protocol and Registration*

We conducted this systematic review of original articles according to a proposal registered at Mashhad University of Medical Sciences (ID: 4001780) and was approved by the Ethics Committee of Mashhad University of Medical Sciences (ID: IR.MUMS.REC.1401.108). The development of the protocol was guided by the 2015 Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols (PRISMA-P) statement (21) and the updated version (i.e., PRISMA 2020 statement) (22). Conduct and reporting followed methodological recommendations for conducting a systematic review, as outlined in Lunny et al's (23) comprehensive publications, which provide recommendations for conducting an overview, and the PRISMA statement.

### *Eligibility Criteria*

All studies that evaluated the educational environment in Iranian medical universities using the DREEM questionnaire, employing an observational design, were included in the study. The target population of included studies was considered to be students and professors in different disciplines of medical sciences universities. No restrictions on time or language were considered. However, letters to the editors and review articles were excluded. If no full text was found even after contacting the authors, the study was also excluded (Table 1).

### *Search Strategy*

We designed a comprehensive search strategy with support from a medical librarian. We employed a comprehen-

*Table 1.* Inclusion and exclusion criteria

| Criteria | Inclusion | Exclusion |
|---|---|---|
| Design | Cross-sectional | Letter to the editor, review articles, short communications |
| Participants | Medicine, nursing, midwifery, health, dentistry, pharmacy, paramedicine, complementary medicine | Students of other disciplines |
| Date | Before March 2024 | — |
| Outcome Measure | Mean and 95% confidence interval (CI) or standard deviation (SD) | Results are not amenable to averaging or standard deviation calculation |
| Setting | University of Medical Sciences in Iran | Other academic settings |
| Databases | PubMed, ERIC, Scopus, Embase, Cochrane Library, CINAHL, Web of Science, Science Direct, Google Scholar, SID, CIVILICA, MAGIRAN | Other databases |
| Language | English, Persian | — |
| Full Text Available | Yes | No |



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sive search strategy to ensure that relevant studies not indexed correctly in the electronic databases were not missed (namely, “DREEM Model” OR “Dundee Ready Educational Environment Measure” OR “quality of clinical education environment” OR “educational climate”). The English and Persian languages were searched separately. We combined search terms and MeSH terms in a search strategy developed for PubMed and adapted it for the other databases. Some keywords that were searched included the educational climate, the quality of the clinical environment, the training field, and the DREEM model. The search query for Google Scholar (to cover grey literature) is {“education* environment” OR “education* climate” OR dreem AND Iran AND “medical sciences”} and the search query for PubMed is {((“education* environment” [Title/Abstract]) OR (“education* climate” [Title/Abstract]) OR (“Education”[Mesh])) AND (medicine OR medical sciences [Title/Abstract]) AND (Dundee Ready Education Environment Measure [Title/Abstract] OR dreem [Title/Abstract]) AND (Iran [Title/Abstract])}

### Electronic Searches

We conducted a comprehensive search across several databases, including PubMed, ERIC, Scopus, Embase, Cochrane Library, CINAHL, Web of Science, ScienceDirect, and Google Scholar, as well as SID, CIVILICA, and MAGIRAN, from December 1st to 10th, 2023. The search was conducted independently by two researchers (MM and MKR), leveraging their expertise in scientific databases to ensure no overlap in the searches.

Initially, we identified 1,343 articles in Google Scholar, 15 in PubMed, 88 in SID, 104 in MAGIRAN, 2 in CINAHL, 120 in ScienceDirect, and 14 in CIVILICA. After removing 250 duplicate records, we screened the remaining articles based on their titles and abstracts. We also examined the reference lists of the included studies for any additional potentially relevant articles. If full texts were unavailable or data were incomplete, we contacted the authors via email. In our final search, we also explored gray literature, but no additional articles were found.

### Selection of Articles

Two reviewers (MM and MKR) independently screened titles and abstracts retrieved from the searches and assessed these for eligibility against the predetermined inclusion criteria (PCC). Considering that the study is in the field of education, the research question is based on the PCC (population, concept, context) framework, which is recommended for educational studies (24, 25). We retrieved all titles and abstracts meeting the inclusion criteria in full text. Two independent reviewers (MM and AS) read these full-text articles to assess eligibility. Disagreements between reviewers were resolved by consensus.

### Assessment of Methodological Quality of Included Reviews

We used the JBI Critical Appraisal Checklist for Analytical Cross-Sectional Studies (2017) to assess the methodological quality of the included articles (26). There are a few quality assessment tools suitable for descriptive cross-sectional studies, and the JBI critical appraisal checklist for studies reporting prevalence data is one of them (27, 28). This instrument has 8 questions: (1) Were the criteria for inclusion in the sample clearly defined? (2) Were the study subjects and the setting described in detail? (3) Was the exposure measured validly and reliably? (4) Were objective, standard criteria used for measurement of the condition? (5) Are there any confounding factors identified? (6) Were strategies to deal with confounding factors stated? (7) Were the outcomes measured validly and reliably? (8) Was an appropriate statistical analysis used? There are four options for each question: Yes (1), No (0), Unclear (0), and not applicable. Question 3 was excluded from this review to ensure the total score ranged from 0 to 7. Two reviewers (MM and MKR) independently performed this assessment. Before the actual evaluation, an educational session was held, and a sample paper was reviewed through a group discussion. Disagreements in the evaluations were handled in a consensus dialogue after comparing discrepancies between assessors. The detailed result of the quality assessment is presented in Table 2.

### Data Extraction

One reviewer (MM) extracted data from the included reviews, and a second reviewer (AS) verified the accuracy of the extraction. In cases where the data was not complete, an attempt was made to request the raw data through correspondence with the author in charge. We extracted the data into a purpose-built data extraction form, adapted from our previously published systematic review and meta-analysis in the field of medical education (29).

### Data Synthesis

We synthesized the data quantitatively when possible. We present the findings from the articles in summary tables of findings for each outcome (questionnaire dimensions) and the number of participants. We report data with weighted mean difference (WMD) and SD. The rescaling of the data shows that we can also use WMD for the aggregated effects, which is easier to interpret than the standardized mean difference (SMD). Effects were estimated using the inverse variance heterogeneity model, a robust estimation method for addressing issues of underestimation of statistical error and overconfident estimates (30). We defined statistical significance as the 95% confidence interval, not including zero. We used the free meta-analysis software (Comprehensive Meta-Analysis version 2) for the statistical analyses (31). A forest plot was generated using the meta-analysis software (CMA) to present the final analysis based on the random-effects model. We also assessed publication bias. Trim and Fill builds on the key idea behind the funnel plot: that in the absence of bias, the plot would be symmetric about the summary effect. If there are more small studies on the right than on the left, the concern is that studies may be missing from the left. The Trim and Fill procedure imputes these missing studies, adds them to the analysis, and then re-computes the summary effect size. By default, the tool will look for





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*Table 2.* Descriptive characteristics of the 39 included articles

| Characteristics | |
|---|---|
| Study design | Cross-sectional: 38 studies<br>Quasi-experimental: 1 study |
| participants | Medical Students: 16 studies; Interns/Externs: 6 studies<br>Nursing Students: 12 studies<br>Midwifery Students: 3 studies<br>Dental Students: 1 study<br>Pharmacy Students: 1 study<br>Paramedicine Students: 1 study<br>Psychology Students: 1 study<br>Anaesthesia Students: 2 studies<br>Operating Room Students: 2 studies<br>Laboratory Students: 2 studies<br>Radiology Students: 2 studies<br>Emergency Students: 2 studies<br>Occupational/Environmental/Public Health Students: 1 study<br>Residents: 6 studies<br>Professors: 2 studies |
| Publication date | 2005-2010<br>• 2007: 1 study<br>• 2008: 2 studies<br>2010-2014<br>• 2010: 1 study<br>• 2012: 1 study<br>• 2013: 2 studies<br>• 2014: 5 studies<br>• 2015: 6 studies<br>2015-2019<br>• 2015: 6 studies<br>• 2016: 3 studies<br>• 2017: 4 studies<br>• 2018: 1 study<br>• 2019: 2 studies<br>2020-2022<br>• 2020: 4 studies<br>• 2022: 1 study |
| language | English: 20 studies<br>Persian: 19 studies |
| Quality assessment Range (1-7) | Score 1-3: 5 studies<br>Score 4-6: 23 studies<br>Score 7: 11 studies |

missing studies to the left of the summary effect. In our research, there is no imputed missing study. In addition, the report tells us that: "Under the fixed effect model, the point estimate and 95% confidence interval for the combined studies is 115.732 (115.239, 116.226). Using Trim and Fill, the imputed point estimate is 119.179 (112.099, 126.260).

## Results

### *Search Results*

The searches retrieved 39 unique records. After screening titles and abstracts, 30 full-text articles were selected for assessment. We included 30 studies. The numbers needed to read were 190, and the precision of the search was 97%.

The flowchart in Figure 1 illustrates the selection process. The supplementary search conducted in March 2024 did not yield any additional articles that met the inclusion criteria.

### *Description of Included Reviews*

The included studies were published between 2007 and 2022. There were 2.5±1.5 (min-max= 0-8) years between the study date and the publication date. The basic characteristics of the included studies are presented in Tables 2 and 3.

### *The Methodological Quality of the Included Reviews*

The JBI checklist for cross-sectional studies was used to perform the quality assessment of the included studies. The median JBI score (of a maximum 7) was 5 (range 1-7). Most articles (20 studies, 49%) suffered from inadequate description of study subjects and the setting, followed by inadequate description of clear definition for inclusion criteria (15 studies, 38%), inadequate dealing with confounding factors (12 studies, 31%), inadequate identification of confounding factors (10 studies, 26%), lack of valid and reliable measurement of outcomes (8 studies, 21%), and inappropriate statistical analysis (1 study, 3%). All studies employed objective, standardized





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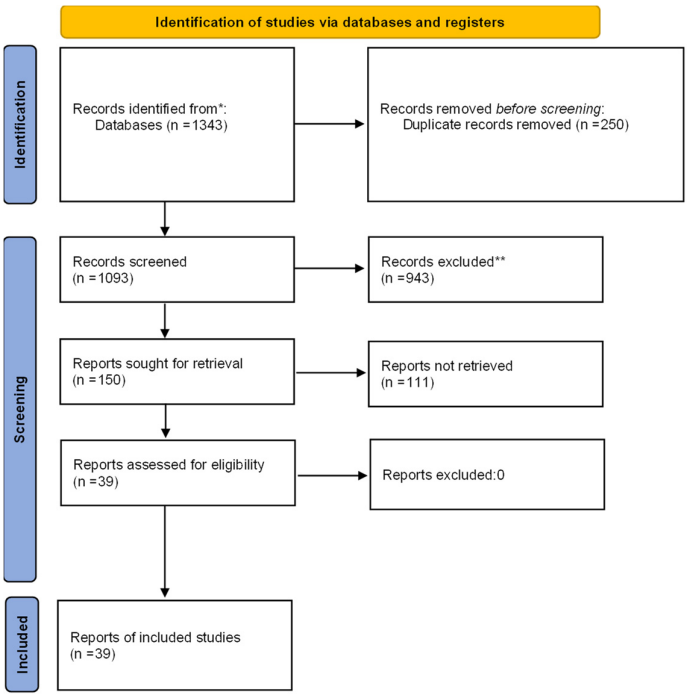


*Figure 1.* The flowchart of the systematic review.

*Consider, if feasible to do so, reporting the number of records identified from each database or register searched (rather than the total number across all databases/registers).
**If automation tools were used, indicate how many records were excluded by a human and how many were excluded by automation tools.
Source: Page MJ, et al. BMJ 2021;372:n71. Doi: 10.1136/bmj.n71.


criteria for measuring the condition.

### Outcome Measures

Data were often transformed and presented with mean, 95% CI, or standard deviation (SD).

### Total Score

In our analysis, a total of 39 studies were included. Among them, 30 studies, comprising 2 psychometric studies of varying quality, provided data on the total score of the DREEM questionnaire and were included in this part of our analysis. Nine studies were excluded for various reasons. Montazeri (2020) reported a total score of 172 based on four dimensions, making it incomparable to other studies. Additionally, seven studies did not report the standard deviation (SD) for the total score: Ghaemi (2015), Farahmand (2014), Managheb (2014), and 4 other studies. Among these, Soltani Arabshahi (2008) and Vatankhah (2015), as well as Soltani Arabshahi (2007), reported only three dimensions (1, 2, and 4), with a total score of 140, which was not comparable to the rest. Ghaemi-Amiri (2015) reported three dimensions (1, 2, and 5) with a total score of 120. Furthermore, Koohpayezadeh (2014) was omitted from the analysis due to the exclusion of six questions from four dimensions.

We were able to pool data for the total score and each dimension of the questionnaire. A meta-analysis of 30 studies yielded a mean score of 119.18 (95% CI: 112.09-126.26) (Figure 2, Table 4).

### Dimension 1-Perception of Learning:

Thirty studies, including two psychometric studies, presented data on the first dimension of the DREEM questionnaire. However, 8 studies were excluded from the analysis for specific reasons. Six of these studies did not report the standard deviation (SD) for the mean of the first dimension, namely Rahbar (2012), Ghaemi (2015), Soltani Arabshahi (2007), Soltani Arabshahi (2008), Farahmand (2014), and Ghaemi-Amiri (2015). In 2 studies (Azizi, 2013; Koohpayezadeh, 2014), 6 questions were omitted, rendering the mean incomparable to those of others.

The pooled data for the first dimension of the questionnaire revealed a mean score of 28.33 (95% CI, 25.96-30.70), as illustrated in Figure 3 and Table 5.

### Dimension 2-Perception of Course Organizers

Out of the 32 studies that reported the second dimension, six studies did not provide the standard deviation (SD) for their data (Rahbar 2012; Ghaemi 2015, Soltani Arabshahi 2007, Soltani Arabshahi 2008, Farahmand 2014; Ghaemi-Amiri 2015). In 2 studies (Azizi 2013; Koohpayezadeh 2014), 6 questions were omitted, rendering the mean incomparable to others.




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*Table 3.* Characteristics of included studies

| First Author (Year) | University | Title | Mean(sd) | Design/ Language | Publication Date | Study Date | Sample Size | Target Population | Male** | Female** |
|---|---|---|---|---|---|---|---|---|---|---|
| Rahbar (2012) | Gilan | Assessment of students' perceptions of educational environment in clinical wards of university hospitals at an Iranian medical sciences university | 107.94 (sd=22.2) | c-s Eng | 2012 | 2011 | 154 | Intern-extern | 90 | 64 |
| Ghaemi (2015) | Babol | Comparison of viewpoints of residents in different courses in babol university of medical sciences towards the clinical learning environment based on the dreem questionnaire | 120.8* | c-s Eng | 2015 | 2013 | 106 | Resident | 56 | 44 |
| Heidari gorji (2013) | Mazandaran | The viewpoints of nursing and midwifery students of Mazandaran University of Medical Sciences regarding the values of teaching and learning using the DREEM model in 2013 | 198.31 (sd=22.4) | c-s Per | 2016 | 2014 | 243 | Nursing and midwifery students | 81 | 162 |
| Heidari hengami (2014) | Hormozgan | An educational survey of the main clinical departments in teaching hospitals of Hormozgan University of Medical Sciences from the point of view of medical students | 104.83 (sd=27.16) | c-s Per | 2015 | 2014 | 184 | Intern-extern | 74 | 98 |
| Rezaei (2017) | Kermanshah | Assessing medical and dentistry students' perception of learning environment in Kermanshah University of Medical Sciences | 92.49 (sd=21.73) | c-s Eng | 2017 | 2015 | 472 | Dental and medical students | 199 | 273 |
| Soltani-arabshahi (2007) | Iran | Examining the professors' workshop about the educational atmosphere of the main clinical departments of the teaching hospitals of Iran University of Medical Sciences based on the modified DREEM model | 116* | c-s Per | 2007 | - | 53 | Professors | - | - |
| Jalili (2014) | Tehran (Azad) | Evaluation of the educational environment based on the DREEM model from the point of view of clinical psychology examinees of the Islamic Azad University of Tehran Medical Sciences | 163.07 (sd=56.69) | c-s Per | 2014 | 2014 | 30 | - | - | - |
| Farajpour (2016) | Mashhad (Azad) | Examining nursing students' perception of teaching-learning environment using DREEM model in Islamic Azad University of Mashhad | 107.05 (sd=23.39) | c-s Per | 2016 | 2014 | 136 | Nursing student in field and semester 2 to 6 | 56 | 80 |
| Aarabi (2020) | Alborz | Studying the educational environment of the main clinical departments of Alborz University of Medical Sciences teaching hospitals from the point of view of medical students | 93.8 (sd=28.9) | c-s Per | 2020 | 2017 | 27 | extern | 39.1% | 60.1% |

*The Standard deviation was not mentioned in the study or it was not possible to aggregate data; c-s=Cross-sectional; Eng= English; Per= Persian

** Data reported as frequency otherwise specified with percentages.



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*Table 3.* Characteristics of included studies

| First Author (Year) | University | Title | Mean(sd) | Design/ Language | Publication Date | Study Date | Sample Size | Target Population | Male** | Female** |
|---|---|---|---|---|---|---|---|---|---|---|
| Montazeri (2014) | Yazd | Perceptions of students and clinical instructors of academic learning environment at yazd university of medical sciences | 110 (sd=21.2) | c-s Eng | 2014 | 2012 | 158 | Final year students of nursing, anaesthesia, operating room, midwifery, laboratory, radiology and their instructors | 49 | 109 |
| Andalib (2015) | Tehran | Evaluation of educational environment for medical students of a tertiary pediatric hospital in Tehran, using DREEM questionnaire | 95.8 (sd=25.4) | c-s Eng | 2015 | 2012 | 77 | 6th year medical students | 24 | 36 |
| Soltani arabshahi (2008) | Iran | Investigation of educational climate in major clinical wards in iran university of medical sciences(IUMS) based on DREEM model | 116* | c-s Eng | 2008 | - | 53 | Professors | 31 | 22 |
| Matlabnegad(2014) | Babol | Evaluation of the educational environment of Babol dental school from the point of view of specialized assistants based on the DREEM model | 114.53 (sd=16.86) | c-s Per | 2014 | 2012-13 | 77 | Residents entered 2009 to 2012 | 27 | 50 |
| Managheb (2014) | Jahrom | Evaluation of the clinical education environment based on the DREEM model from the perspective of nursing students of Jahrom University of Medical Sciences in 1990 | 96.58* | c-s Per | 2014 | 2011 | 174 | Nursing intern | 47 | 56 |
| Zarvaj hoseini (2015) | Shahrood | Examining students' views of the teaching and learning environment based on the DREEM model at Shahrood University of Medical Sciences in 2013 | 117.22 (sd=23.67) | c-s Per | 2015 | 2014 | 332 | Students of the following fields: Medicine, midwifery, nursing, anaesthesia Operating room, emergency,occupational/environmental/public health. | 35.8% | 64.2% |
| Vatankhah (2015) | Kerman | Investigating the quality of the clinical ventilation environment of teaching hospitals of Kerman University of Medical Sciences from the professors' point of view | 121.19* | c-s Per | 2015 | 2012 | 50 | Professors | | |



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*Table 3.* Characteristics of included studies

| First Author (Year) | University | Title | Mean(sd) | Design/ Language | Publication Date | Study Date | Sample Size | Target Population | Male** | Female** |
|---|---|---|---|---|---|---|---|---|---|---|
| Jafari (2020) | Ahvaz | Investigating the relationship between nursing students' perception of the educational environment and the level of their academic involvement in Jundishapur University of Medical Sciences, Ahvaz in the academic year 2017-2018 | 125.6 (sd=12.81) | c-s Per | 2020 | 2018-19 | 291 | nursing students | 93 | 198 |
| Daryazadeh (2020) | Kashan | Evaluation of clinical environment from the perspective of medical learners of Kashan University of Medical Sciences based on DREEM model in 2018 | 90.78 (sd=17.72) | c-s Eng | 2020 | 2018 | 145 | Intern-extern-resident | 43.8% | 56.2% |
| Faghani (2013) | Golestan | Examining students' views on educational atmosphere (DREEM model) in Golestan University of Medical Sciences in 2019 | 160.2 (sd=21.30) | c-s Per | 2013 | 2011 | 48 | Students of medicine, nursing-midwifery, paramedicine | 46 | 102 |
| Soltaniarabshahi (2008) | Iran | The educational environment of the main clinical departments of Iranian medical sciences teaching hospitals from the perspective of learners based on the DREEM model | 140.6 (sd=23.21) | c-s Per | 2008 | 2006 | 193 | Resident-Intern | 106 | 90 |
| Bagheri (2019) | ghom | Evaluation of the educational climate and related factors from the perspective of Qom University of Medical Sciences students in 2017 | 114.1 (sd=23.3) | c-s Per | 2019 | 2017-18 | 306 | University students | 215 | 91 |
| Montazeri (2020) | Jahrom | Investigation of nursing students; perceptions regarding the educational atmosphere of pharmacology course at jahrom university of medical sciences | 98.5* (sd=18.86) | c-s Eng | 2020 | 2015 | 30 | All nurses in the pharmacology course | 14 | 16 |
| Hasanabadi (2017) | Rafsanjan | Examining medical students' understanding of the learning environment at Rafsanjan University of Medical Sciences in 2014 | 89.01 (sd=22.74) | c-s Per | 2017 | 2015 | (260)370 | All medical students from 2015-16(Feb) | 100 | 160 |
| Sayadi (2015) | Kordestan | Examining Kurdistan University of Medical Sciences students' understanding of the educational environment based on the DREEM model in 2014 | 109.04 (sd=22.03) | c-s Per | 2017 | 2014-15 | 300 | Medical students between 2nd and 8th semester | | |
| Mousavi (2014) | Iran | Assessment of the educational environment of the main clinical departments of Iran University of Medical Sciences from the point of view of interns based on the modified DREEM model | 96.1 (sd=21.64) | c-s Per | 2014 | 2012-13 | 250 | Intern-extern | 82 | 181 |
| Zolfaghari (2015) | Birjand | The point of view of medical students on the clinical training environment of teaching hospitals covered by Birjand University of Medical Sciences based on the DREEM model | 155.03 (sd=27.86) | c-s Per | 2015 | 2013-14 | 116 | Intern-resident | 51 | 65 |
| Bakhshi (2013) | Rafsanjan | Nursing students' perceptions of their educational environment based on DREEM model in an Iranian university | 114.3 (sd=20.6) | c-s Eng | 2013 | 2009 | 202 | nursing students | 91 | 111 |



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*Table 3.* Characteristics of included studies

| First Author (Year) | University | Title | Mean(sd) | Design/ Language | Publication Date | Study Date | Sample Size | Target Population | Male** | Female** |
|---|---|---|---|---|---|---|---|---|---|---|
| Bakhshi (2014) | Rafsanjan | students' perceptions of the educational environment ia an Iranian model school,as measured by the Dundee reasy education environment measure | 113.8 (sd=17.31) | c-s Eng | 2014 | 2010 | 234 | Medical students before 6th year | 106 | 128 |
| Aghamolaei (2010) | Hormozgan | Medical students' perceptions of the educational environment at an Iranian medical sciences university | 99.6 (sd=22.9) | c-s Eng | 2010 | 2009 | 210 | Medical students of the course of basic sciences and patho-physiology | 38.5% | 61.5% |
| Bakhshialiabad (2015) | Rafsanjan | students' perceptions of the academic learning environment in seven medical sciences courses based on DREEM | 113.5 (sd=21.9) | c-s Eng | 2015 | 2009-10 | 527 | University students((BSc) | 201 | 292 |
| Farahmand (2014) | Tehran | Evaluating the quality of the educational environment for medical interns in an emergency department using the DREEM inventory | 134.79* | c-s Eng | 2014 | 2009-2010 | 156 | interns in emergency ward | 69 | 87 |
| Farajpour (2017) | Mashhad (Azad) | Perception of educational environment among undergraduate student of health disciplines in an Iranian university | 106 (sd=24.6) | c-s Eng | 2017 | 2015 | 378 | Students of: Medicine-nursing-midwifery | 80 | 298 |
| Imanpour (2015) | Tehran | Evaluating the educational environment of a nursing school by using the DREEM inventory | 104.39 (sd=22.5) | c-s Eng | 2015 | 2013 | 500 | Midwifery & nursing students | 89 | 281 |
| Bakhshialiabad (2019) | Rafsanjan | Improving students' learning environment by DREEM: an educational experiment in an Iranian medical sciences university(2011-2016) | 118.49 (sd=16.65) | prospective quasi-experimental study Eng | 2019 | 2011-2016 | 982 | Nursing-midwifery-radiology-operating room-laboratory-anaesthesiology-emergency department students | 201 | 292 |
| Koohpayezadeh (2014) | Iran | Assessing and reliability of Dundee ready educational environment measure(DREEM) in Iran | 96.15 (sd=21.64)* | c-s Eng | 2014 | 2012-2013 | 267 | Intern, extern | 82 | 181 |
| Behkam (2022) | Tehran | students' perceptions of educational environment based on Dundee ready education environment measure and the role of peer mentoring: a cross-sectional study | 144 (sd=19.3) | c-s Eng | 2022 | 2019 | 169 | First year medical students | 86 | 83 |
| Falah langroudi (2012) | Mazandaran | Validation of the Persian version of the Educational Environment Measurement Questionnaire (Dreem) | 127.53 (sd=23.66) | c-s Per | 2012 | 2011-12 | 250 | medical students | 202 | 148 |
| Azizi (2013) | Mazandaran | Attitudes of pharmacy students to educational conditions in Mazandaran university of medical sciences | 152.13 (sd=20.65) | c-s Eng | 2013 | 2012 | 86 | Pharmacology students | 32 | 56 |
| ghaemi-amiri (2015) | Babol | The viewpoint of residents studying in hospitals affiliated to Babol university of medical sciences and health services on clinical training environment | 117.81* | c-s Eng | 2015 | - | 100 | Resident | 66 | 34 |



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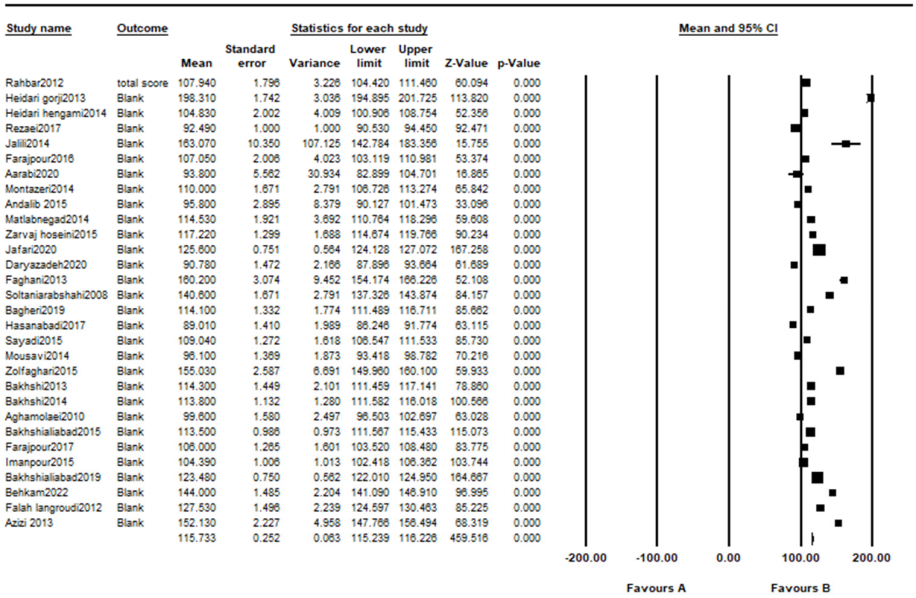


*Figure 2.* The forest plot of included studies for pooling the total score of DREEM

*Table 4.* The pooled estimate of the Total score for DREEM

| Model | Effect size (95% CI) | | | Test of null | Heterogeneity | | | Tau-squared |
|---|---|---|---|---|---|---|---|---|
| | Point estimate | Lower limit | Upper limit | *P*-value | Q-value | *P*-value | I-squared | |
| Fixed | 115.73 | 115.23 | 116.22 | <0.001 | 5764.691 | <0.001 | 99.497 | 385.02 |
| Random | 119.18 | 112.09 | 126.26 | <0.001 | | | | |

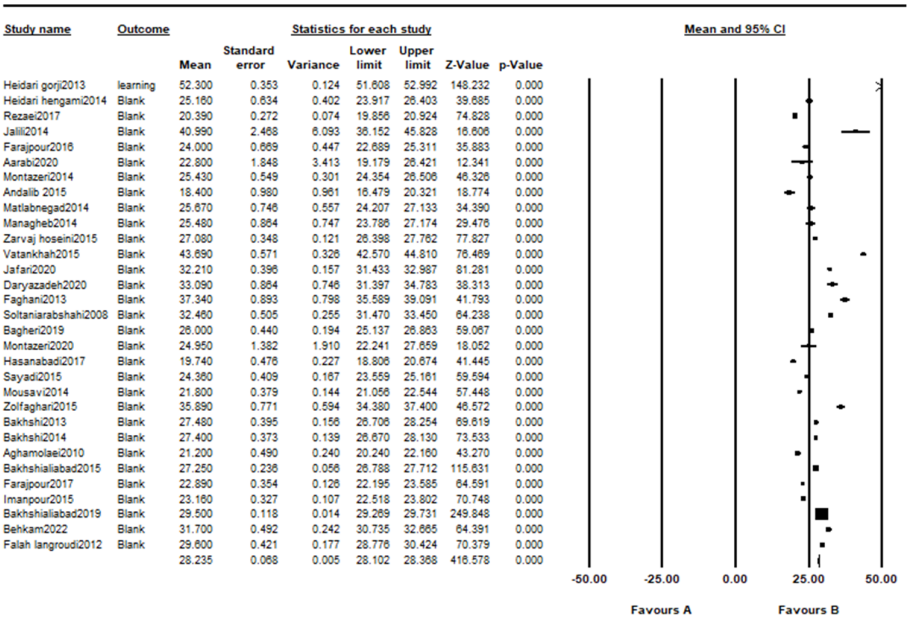


*Figure 3.* The forest plot of included studies for the pooling perception of learning of DREEM

The pooled data for the second dimension of the questionnaire indicated a mean score of 26.33 (95% CI: 24.45-28.21), as depicted in Figure 4 and Table 6.

### *Dimension 3-Academic Self-Perception*

A total of 30 studies reported the third dimension and were included in our analysis. Ten studies were excluded because three did not provide the standard deviation (SD) for their data (Rahbar, 2012; Ghaemi, 2015; Farahmand, 2014). In 2 studies (Azizi, 2013; Koohpayezadeh, 2014), six questions were omitted, making the mean incomparable to those of others. In 4 studies (Soltani Arabshahi



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*Table 5.* The pooled estimate of the perception of learning score for DREEM

| Model | Effect size (95% CI) | | | Test of null | | Heterogeneity | | Tau-squared |
|---|---|---|---|---|---|---|---|---|
| | Point estimate | Lower limit | Upper limit | *P*-value | Q-value | *P*-value | I-squared | |
| Fixed | 28.235 | 28.102 | 28.368 | <0.001 | 8478.578 | <0.001 | 99.646 | 44.788 |
| Random | 28.336 | 25.964 | 30.708 | <0.001 | | | | |

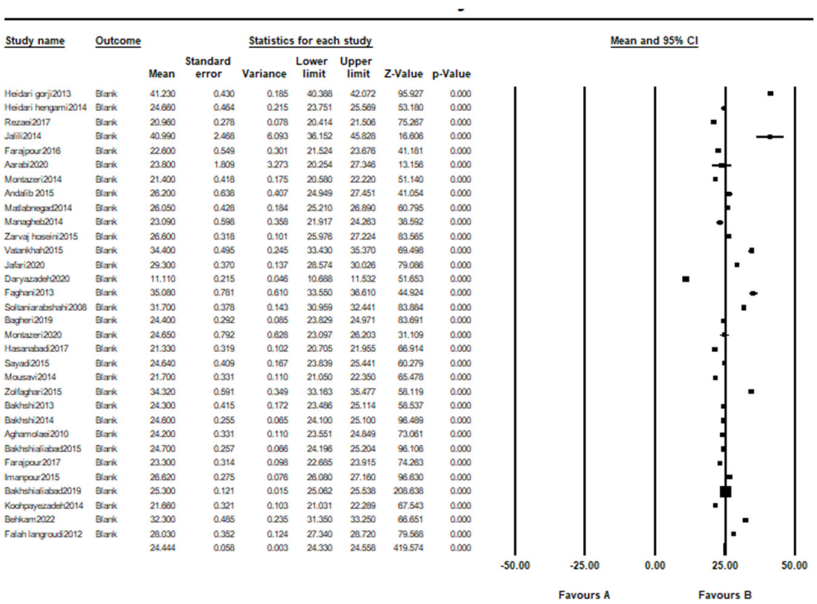


*Figure 4.* The forest plot of included studies for the pooling perception of course organizers of DREEM

*Table 6.* The pooled estimate of the perception of course organizers' score for DREEM

| Model | Effect size (95% CI) | | | Test of null | | Heterogeneity | | Tau-squared |
|---|---|---|---|---|---|---|---|---|
| | Point estimate | Lower limit | Upper limit | *P*-value | Q-value | *P*-value | I-squared | |
| Fixed | 24.44 | 24.33 | 24.55 | <0.001 | 7850.984 | <0.001 | 99.605 | 28.87 |
| Random | 26.33 | 24.45 | 28.21 | <0.001 | | | | |

2008, Soltani Arabshahi 2007; Vatankhah 2015; Ghaemi-Amiri 2015), the third dimension was not reported.

The pooled data for the third dimension of the questionnaire revealed a mean score of 20.49 (95% CI: 18.49-22.50), as illustrated in Figure 5 and Table 7.

### *Dimension 4-Perception of Learning Atmosphere*

A total of 31 studies reported the fourth dimension and were included in our analysis. However, nine studies were excluded, with five not providing the standard deviation (SD) for their data (Rahbar 2012; Ghaemi 2015; Soltani Arabshahi 2007; Soltani Arabshahi 2008; Farahmand 2014). In two studies (Azizi, 2013; Koohpayezadeh, 2014), six questions were omitted, resulting in incomparable means. Additionally, in one study (Ghaemi-Amiri 2015), the fourth dimension was not reported.

The pooled data for the fourth dimension of the questionnaire indicated a mean score of 27.19 (95% CI, 25.42-28.96), as depicted in Figure 6 and Table 8.

### *Dimension 5-Social Self-Perception*

In our analysis, 29 studies reported the fifth dimension. However, 11 studies were excluded, as 4 did not provide the standard deviation (SD) for their data (Rahbar, 2012; Ghaemi, 2015; Farahmand, 2014; Ghaemi-Amiri, 2015). In 5 studies (Azizi 2013; Soltani Arabshahi 2008, Soltani Arabshahi 2007; Vatankhah 2015; Montazeri 2020), the fifth dimension was not reported.

The pooled data for the fifth dimension of the questionnaire revealed a mean score of 17.52 (95% CI, 16.30-18.74), as illustrated in Figure 7 and Table 9.

Table 10 shows the aggregated results in various dimensions and the total score of the DREEM questionnaire. It can be observed that the number of included studies varies across different dimensions, and the heterogeneity index is high, with a significant P-value, which justifies the use of random effects models.

## Discussion

The future of every society is closely tied to its human resources. One of the primary concerns in this regard is the provision and promotion of health. The medical sciences universities are responsible for training the required workforce. In other languages, current students in various medical sciences disciplines are often regarded as the future guardians of health in every society. With this issue in





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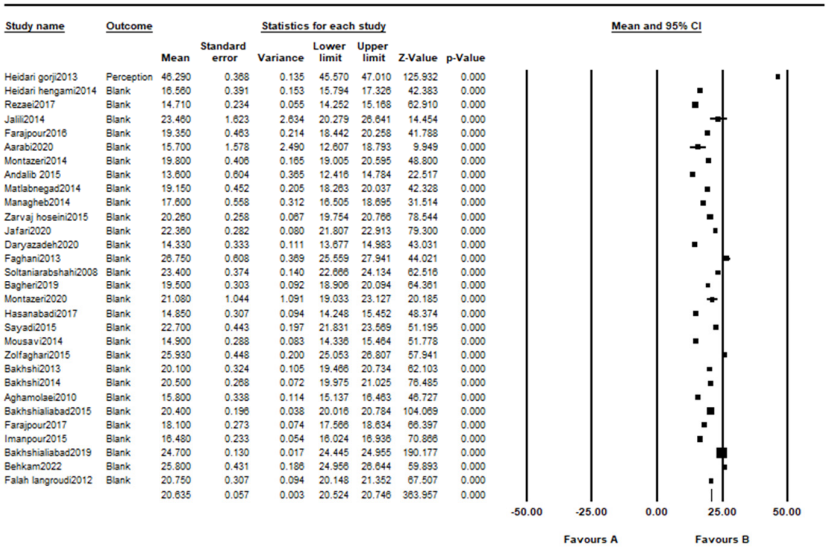


*Figure 5.* The forest plot of included studies for pooling academic self-perception of DREEM

*Table 7.* The pooled estimate of academic self-perception score for DREEM

| Model | Effect size (95% CI) | | | Test of null | Heterogeneity | | | Tau-squared |
|---|---|---|---|---|---|---|---|---|
| | Point estimate | Lower limit | Upper limit | *P*-value | Q-value | *P*-value | I-squared | |
| Fixed | 20.63 | 20.52 | 20.74 | <0.001 | 9042.094 | <0.001 | 99.679 | 31.132 |
| Random | 20.49 | 18.49 | 22.50 | <0.001 | | | | |

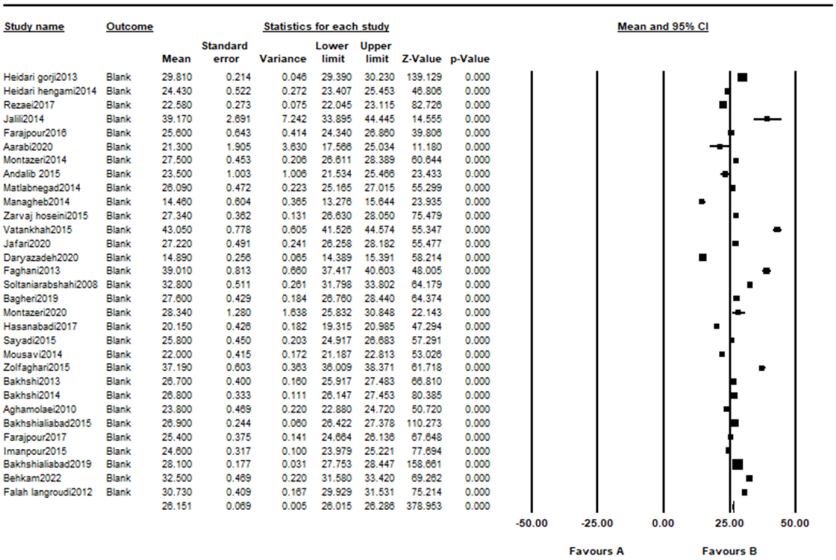


*Figure 6.* The forest plot of included studies for pooling perception of learning atmosphere of DREEM

*Table 8.* The pooled estimate of perception of learning atmosphere score for DREEM

| Model | Effect size (95% CI) | | | Test of null | Heterogeneity | | | Tau-squared |
|---|---|---|---|---|---|---|---|---|
| | Point estimate | Lower limit | Upper limit | *P*-value | Q-value | *P*-value | I-squared | |
| Fixed | 26.151 | 26.015 | 28.286 | <0.001 | 4887.167 | <0.001 | 99.386 | 24.715 |
| Random | 27.192 | 25.422 | 28.962 | <0.001 | | | | |

mind, the educational system needs high attention. The prerequisite for every plan is having robust knowledge about the current condition. Education research in medical sciences often suffers from providing an overall image and instead focuses on individual studies. For example, this was also true for evaluating the educational quality of services based on the SERVQUAL model in Iran (29, 32-35), which was supported by a systematic review and meta-analysis (36). Regarding the educational environment, we found a considerable number of individual studies





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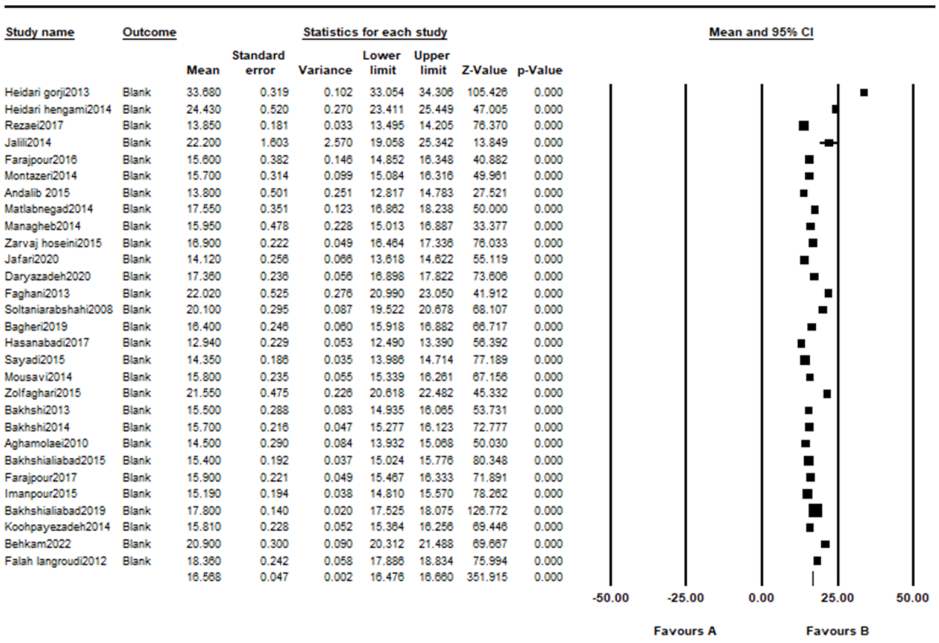


*Figure 7.* The forest plot of included studies for pooling the social self-perception of DREEM

*Table 9.* The pooled estimate of the social self-perception score for DREEM

| Model | Effect size (95% CI) | | | Test of null | Heterogeneity | | | Tau-squared |
|---|---|---|---|---|---|---|---|---|
| | Point estimate | Lower limit | Upper limit | *P*-value | Q-value | *P*-value | I-squared | |
| Fixed | 16.568 | 16.476 | 16.660 | <0.001 | 4787.041 | <0.001 | 99.415 | 11.104 |
| Random | 17.526 | 16.453 | 18.747 | <0.001 | | | | |

*Table 10.* The aggregated results of the 5 dimensions and the total score of DREEM

| | N | SE | Effect size with 95% CI (Random effect model) | Heterogeneity ($I^2$) | Tau-squared | *P*-value |
|---|---|---|---|---|---|---|
| Total score | 30 | 3.61 | 119.18(112.09 -126.26) | 99.49 | 385.02 | <0.001 |
| Dimension 1 (perception of learning) | 31 | 1.21 | 28.33 (25.96 – 30.70) | 99.64 | 44.78 | <0.001 |
| Dimension 2 (perception of course organizers) | 32 | 0.95 | 26.33(24.45 - 28.21) | 99.60 | 28.87 | <0.001 |
| Dimension 3 (academic self-perception) | 30 | 1.02 | 20.49(18.49 - 22.50) | 99.67 | 31.13 | <0.001 |
| Dimension 4 (perception of learning atmosphere) | 31 | 0.90 | 27.19(25.42-28.96) | 99.38 | 24.71 | <0.001 |
| Dimension 5 (social self-perception) | 29 | 0.62 | 17.52(16.45-18.74) | 99.41 | 11.10 | <0.001 |

conducted in various universities in Iran. However, the need to provide a single pooled result for decision-makers was present.

This study showed no considerable publication bias; moreover, the included studies had an acceptable quality based on the JBI (5.5 out of 7). The result showed that the pooled total score of the DREEM questionnaire was 119.1 (out of 200) among published studies in Iran. Since the included studies were from various universities and the target groups were diverse (namely, different majors and disciplines), we encountered a high heterogeneity. However, using a random effect model could provide a pooled overview of the educational environment in Iran.

The lowest score was observed in social self-perception among the 5 dimensions. The questions of this domain are: There is a sound support system for students who get stressed; I am too tired to enjoy this course; I am rarely bored in this course; I have good friends in this school; My social life is good; I seldom feel lonely; and My accommodation is pleasant. Therefore, it appears that the social support system in medical sciences universities should reevaluate their strategies to provide a more efficient delivery of services. It should be noted that the findings are based on self-reports, so it can be assumed that the present services are sufficient; however, the perception of end-users shows a point that needs action. It can be suggested that empowering students with essential soft skills, including stress management, time management, and future planning, can foster a more positive environment in universities.

The second domain with the lowest score was academic self-perception. The questions of this domain are Learning strategies that worked for me before continue to work for me now; I am confident about passing this year; I feel I am being well prepared for my profession; Last year's work was good preparation for this year's work; I can memorize all I need; I have learned a lot about empathy in my profession; My problem-solving skills are being well developed; and much of what I have to learn seems relevant to a career in healthcare. This domain primarily fo-





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cuses on preparing for a future career. It is not surprising that student plans for their future even in the first semester after entering university (37). However, their motivation and expectations for future careers can change during the education period (37, 38). Therefore, a robust support system needs to be reestablished to ensure that the high-value motivational factor remains intact even after graduation and that students are well-prepared for their future responsibilities. In their systematic review of 24 articles about the competencies of physicians in Iran, Changiz et al reported that in 70% of assessed skills, physicians' competencies were estimated as low to moderate (39). Another report from Bandarabas University of Medical Sciences showed that the highest acquired competency in graduate medical students was clinical and communication skills, and all other competencies were below average. The authors suggested that a fundamental revision of educational methods, resources, and topics related to teaching and learning is necessary (40).

The first middle score belonged to the perception of the course organizers' dimension. The questions in this domain are: Are the program organizers knowledgeable? Do the lectures emphasize student care during the teaching sessions? Do teachers ridicule the registrars? The teachers are authoritarian; The teachers have good communication skills with the students; The teachers are good at providing feedback to students; The teachers provide constructive criticism here; The teachers give clear examples; The teachers get angry in teaching sessions; The teachers are well prepared for their classes; I feel able to ask the questions I want. Therefore, it seems that the course arrangement was not on the right path. Since students encounter patients in various clinical settings, their course should be planned, and teachers should serve as role models (41). The findings of research by Rokhafrooz et al highlighted the need for faculty development programs to enhance teaching skills (42). Additionally, the studies were conducted in Eastern Nepal (43) and Sri Lanka (44), where students also held a fairly positive perception. There is a contrast in these studies with our results.

Regarding the second middle score, it was presented in relation to the perception of the learning atmosphere domain. The questions in this domain are as follows: The atmosphere is relaxed during teaching sessions; this program is well-timed. Cheating is a problem in this program. The atmosphere is relaxed during lectures; There are opportunities for me to develop interpersonal skills. I feel comfortable in class socially. The atmosphere is relaxed during seminars/tutorials. I find the experience disappointing. I can concentrate well. The enjoyment outweighs the stress of the program. The atmosphere motivates me as a learner. Hence, based on the results, it can be inferred that the learning atmosphere was appreciated to some extent by the participants. The most influential sub-branch in the quality of clinical education was reported in the field of educational environment (45). Another study from Rasht University of Medical Sciences represented the highest satisfaction among dentistry students (46).

Moreover, the greatest score was associated with students' perception of learning. The questions of this domain are as follows: I am encouraged to participate in a teaching session. The teaching is often stimulating. The teaching is student-centered. The teaching helps to develop my competence. The teaching is well-focused. I feel that I am well-prepared for my profession. The teaching time is put to good use. The teaching overemphasizes factual learning. I am clear about the learning objectives of the program. The teaching encourages me to be an active learner, with a focus on long-term learning over short-term learning. However, the teaching is too teacher-centered. It is clear that the learning rate was stabilized, as indicated by the highest score. This illustrates that learning occurs through high levels of pleasure in clinical fields and training environments. Orakifar et al reported that the educational environment was in good condition and the attitude of students was positive (47). In addition, Rokhafrooz et al (42) reported the maximum score for students' perceptions of learning. Another study in Chile also found similar results (48). It appears that the highest mean score in this domain is due to the effective planning of the schedule and table time training.

This study is not without limitations. We encountered high heterogeneity among studies, which was due to the diversity of included studies in terms of majors and disciplines. This was addressed using a random effects model. However, to the best of our knowledge, there are no published systematic reviews or meta-analyses on DREEM, and this study can provide sufficient evidence for educational decision-makers.

## Conclusion

The prerequisite for every plan is a profound understanding of the current condition. This is the first systematic review and meta-analysis study in Iran, which provided an overall picture of the quality of the educational climate based on the DREEM model. The review results indicate that the total score is moderately higher than 50%, suggesting considerable room for improvement. Furthermore, social self-perception has the lowest situation and needs high attention and much further national planning for improvement.

### *Authors' Contributions*

Conception and study design: M.K.R., R.V.
Data gathering: R.V., M.M.
Data analysis: M.K.R., A.S.
Drafting the manuscript: R.V., A.S., M.M.
Critical revising of the manuscript: M.K.R., A.S.
Final approval: M.K.R., R.V., A.S., M.M.

### *Ethical Considerations*

This study was approved by the Ethics Committee at Mashhad University of Medical Sciences (ID: IR.MUMS.REC.1401.108).

### *Acknowledgment*

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### *Conflict of Interests*

The authors declare that they have no competing interests.

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