

Review Article

Critical Thinking Level among Medical Sciences Students in Iran

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Background. Critical thinking is one of the most important missions of the educational planning system of medical sciences universities around the world. Hence, identifying the level of critical thinking skills and tendency of medical sciences students to think critically is of great importance. Therefore, the aim of this systematic review was to examine the critical thinking level in medical sciences students in Iran. **Methods.** To extract published studies in the field of critical thinking in Iran, a search was conducted in the databases of PubMed, Web of Science, Scopus, ERIC, and Magiran. The keywords of critical thinking, medical sciences, and Iran were used for the purpose of the search in the two languages of Persian and English and without any time limit. The PRISMA flow diagram was applied for the selection of articles, and the Newcastle–Ottawa Scale was used for the evaluation of these papers. **Results.** After evaluating the quality of searched articles, 80 articles were finally selected for the final analysis. The total sample of the articles included 12,578 students. The results indicated that out of 51 articles conducted in the field of critical thinking skills, 48 articles reported these skills at a low level, 2 papers at a medium level, and only 1 paper at a high level in the medical sciences students. Among 29 articles in the field of the level of critical thinking disposition, 13 articles reported their tendency level at a low level, 11 articles at a medium level, and 5 articles at a high level. **Conclusion.** In general, based on most articles, the level of critical thinking skills in the medical sciences students in Iran was reported to be at a low level and their tendency to critical thinking at a moderate level and low level. Therefore, given the importance of critical thinking for medical sciences students, future studies should consider factors influencing the increase of the critical thinking level in these students. In this regard, formation of some training workshops can also be promising. Furthermore, reviewing the medical sciences curriculum should be taken into consideration by the policymakers and educational planners so as to strengthen the level of critical thinking in the medical sciences students.

1. Introduction

Critical thinking is a major principle in the universities of the third millennium. Nowadays, along with new functions of universities such as entrepreneurship, critical thinking is also considered a new function [1]. In the age of information explosion and transition from the industrial society to a knowledge-based society, critical thinking is a key necessity in training capable manpower [2]. Owing to the growth of information and communications (e.g., radio, television, and social networks), we are experiencing a large volume of information everyday [3]. Therefore, critical thinking helps individuals to

differentiate correct information from incorrect information and make an accurate assessment of events [4]. Critical thinking is one of the most important necessities and qualifications of living in the modern world. Health sciences students, as one of the most important pillars of the healthcare systems, should possess critical thinking in order to be able to make better decisions in dealing with different phenomena and situations [5]. Today, it is emphasized that the critical thinking, as a vital skill in the diagnostic and therapeutic decision-making, should be considered in the teaching-learning process [6–9]; as in the case of providing educational infrastructure, critical thinking can have an impact on the improvement of the

quality of the teaching-learning process [10]. Critical thinking is considered as one of the dimensions of thinking and a way of thinking. Critical thinking represents a logical and argumentative thought formed as a regular and organized mental process. It focuses on the way we make decision and what we must believe [11].

Critical thinking is an essential data analysis skill that facilitates the identification, assessment, reasoning, judgment, and decision-making processes [12]. Critical thinking involves critical thinking skills and disposition. Skills form the cognitive aspect and disposition form the emotional aspect of the critical thinking. The cognitive skills forming the core of the critical thinking include the dimensions of the analysis, inference, and evaluation.

Analysis is defined as the ability to diagnose goals in different domains and to discover their relationships. Inference is also defined as the ability to diagnose valid empirical elements and evidence to make a decision about a phenomenon. Assessment is defined as validating different perspectives about a phenomenon [13, 14].

Studies emphasize the importance of critical thinking skills. A study on Iranian students in 2016 showed a significantly positive relationship between critical thinking skills and decision-making ability. According to this study, critical thinking skills are one of the most important prerequisites necessary for professional competence and proper decision-making [15]. Another study in 2018 indicated a significantly positive relationship between students' inference and scientific reasoning [8]. A study in 2013 also showed a significantly positive association between decision-making (as one of the dimensions of critical thinking skills) and self-efficacy beliefs [16]. Furthermore, a study on Australian students indicated a significant relationship between critical thinking skills and academic performance [17]. Moreover, a study in 2017 showed teaching critical thinking skills significantly improved the students' problem-solving skills [18].

Disposition to critical thinking indicates the inclination to think critically, and it includes the dimensions of open-mindedness, truth-seeking, analytical, systematic, critical self-confidence, inquisitiveness, and maturity of judgment [19–22]. Open-mindedness: people with open-mindedness characteristics are patients against the diversity of beliefs and respect other people's rights. Truth-seeking characteristics: people with truth-seeking characteristics are brave enough to ask questions and are correct in seeking information. Analytical: to be analytical indicates the tendency toward the intelligent study of phenomena and the use of reasoning. Systematic features: individuals with systematic features adopt an orderly strategy in the analysis of events and phenomena. These people also have a high level of concentration. Critical self-confidence: individuals with critical self-confidence believe in their abilities and skills. Inquisitiveness: inquisitive people tend to acquire knowledge and new information and enjoy new affairs. Maturity of judgment: cognitive development is an important indication of the maturity of judgment. Individuals who have this characteristic make judgments based on defined and transparent criteria [23].

Ricketts suggests that critical thinking tendencies include the cognitive maturity, mental conflict, and creativity [24]. Mental conflict: mental conflict is indicative of seeking opportunities to use reasoning in various situations. Creativity indicates individuals' talent and ability in inquisitiveness and desire to discover the truth. Cognitive maturity: cognitive maturity is defined as knowing about the complexity of subjects, tolerating others' beliefs, and knowing about one's and others' prejudices.

Several studies have been performed on critical thinking and its relationship with other variables. A study among Canadian students in 2003 showed that the tendency to think critically plays a principal role in critical thinking skills [25]. A significant association has also been reported between the tendency to critical thinking and clinical competence of Korean nurses [26]. Another study in 2017 indicated a significantly positive relationship between the tendency to critical thinking and academic self-efficacy in the Malaysian teachers [27]. Furthermore, a study among Turkish students showed that critical thinking tendencies had a significantly positive effect on social-emotional learning domains [28]. Moreover, a study in 2017 indicated a significantly positive association between critical thinking tendencies, problem-solving, and the desire for empathy [29].

Several studies conducted in Iran on the level of critical thinking in medical sciences students obtained different results. Thus, there is a need for a comprehensive review of these studies. Consequently, the present study aims to provide a clear and accurate picture of the critical thinking level in medical sciences students in Iran through a comprehensive and systematic review of studies conducted in this regard.

2. Materials and Methods

2.1. Study Questions. This systematic review sought to answer this question:

- (1) What are the features of materials and methods (research method, sampling method, and critical thinking measurement tools) in studies related to the critical thinking of the medical science students in Iran
- (2) What is the level of Iranian medical sciences students' critical thinking skills
- (3) What is the level of Iranian medical sciences students' critical thinking disposition

2.2. Data Collection and Search Strategy. The search was carried out at the international databases of PubMed, Web of Science, Scopus, and ERIC and the Persian language database of Magiran (the most comprehensive database in Persian); the search was conducted without the time limit. To find articles related to the purpose and question of the study, the keywords of critical thinking, medical sciences, and Iran were used in combination with the mediator AND. The search strategy at the databases of PubMed, Web of

Science, Scopus, and ERIC was based on the following combination:

- (1) ((critical thinking [Title/Abstract]) AND medical sciences [Title/Abstract]) AND Iran [Title/Abstract]
- (2) (Critical thinking [Title/Abstract]) AND Iran [Title/Abstract]

2.3. Inclusion/Exclusion Criteria. The inclusion criteria for the study consisted of the publication of articles in Persian and English, the availability of the abstract and full text of articles, conduction of research in Iran, originality of articles (descriptive, analytical, and empirical), and the relevance of article to the purpose and question of the study. The exclusion criteria contained duplication of the titles of articles, letter to editor, and review articles.

2.4. The Process of Selecting and Evaluating Articles. The PRISMA flow diagram was applied to select articles, as shown in Figure 1. The process of searching and selecting articles was designed in accordance with the purpose of the study. In the preliminary search process, out of 486 Persian and English articles extracted, 114 articles were deleted due to duplication. In the next step, in the process of reviewing the title and abstract of the articles, 285 articles were deleted. In the final step, the full text of 87 articles was reviewed and 7 articles were deleted. Finally, 80 articles were included in the study. The quality of these articles was examined using the Newcastle–Ottawa Quality Assessment Scale (case control/cross-sectional studies) [30, 31]. In the studied articles, the target group was medical sciences students. The term “medical sciences” refers to allied health professions. In Iran, medical sciences students refer to students majoring in health sciences.

2.5. Data Analyze. The Newcastle–Ottawa Scale evaluates articles in terms of the three dimensions of the subject selection process, comparability, and results. Based on this scale, the articles were rated in terms of the quality from 0 (the weakest study) to 9 (the strongest study) [31]. Studies scored less than 4 were evaluated as a low quality study. To extract information from the selected studies, the researchers designed a checklist containing the items of the author’s name, study title, study design (method), sample, sampling method, data collection tool, and results.

2.6. Ethical Considerations. This study was approved by the university’s ethics committee.

3. Results

After searching, 486 articles were obtained from the Persian and international databases. The Endnote-10 software was used to organize the articles. Using this software, 285 articles were removed due to being repetitive and irrelevant. Subsequently, the researchers investigated the full text of 87 articles. Among the total of 87 articles, 80 articles were finally

evaluated in terms of quality and 7 articles were excluded (Table 1). In this regard, 3 articles were excluded due to republishing in various journals, two articles for not referring to critical thinking, and two articles due to the vagueness of the results and the uncertainty of how the scoring was conducted. Subsequently, the results were presented in 8 axes, including the author’s name, year of publication, study design (method), sample size, sampling method, data collection tools, results, as well as the language of the articles.

The results indicated that all 80 articles were published during the period 2004–2018. The total sample of the 80 articles was 12,578 students. In the 60 studies performed, most of the samples were female students. Regarding the language of publication, 69 articles were published in Persian and 11 articles in English.

The characteristics of the materials and methods of studies investigated are presented in Table 2. The sampling method in 27 articles was reported to be of a census method, the convenience method in 10 articles, the random method in 8 articles, the stratified random method in 19 articles, the systematic random method in one article, cluster random in 7 articles, purposive in one article, and finally, no sampling method in 7 articles (Table 2).

In terms of the study method, 65 articles were conducted using the cross-sectional method (descriptive or analytical), 13 articles using the quasiexperimental method, and one study using the longitudinal method, and one article using the causal-comparative method (Table 2).

The analysis of articles showed that 29 out of 80 articles studied were about critical thinking. Among the total studies conducted regarding critical thinking disposition, 14 studies used the Ricketts critical thinking disposition scale and 15 articles used the California Critical Thinking Disposition Inventory (CCTDI). There were also 51 articles on critical thinking skills, 46 of which used the California Critical Thinking Skills Test, Form B (CCTST, FB), and 5 articles used the Watson–Glaser Critical Thinking Appraisal (WGCTA) (Table 2). The range of scores is 0–34 for CCTST-FB, 75–350 for CCTDI, 0–16 for WGCTA, and 33–165 for Ricketts’ Critical Thinking Disposition. Therefore, in this study, the level of critical thinking in students was determined based on the cut score and the range of scores mentioned in psychometric studies.

In investigating the selected articles, we encountered two categories of articles. A number of articles focused on critical thinking skills and some articles on critical thinking disposition. Thus, in this article, the amount of critical thinking is presented in terms of skills and disposition.

Among the articles studied, 42 variables were used along with the critical thinking variable. Of these, 16.66% was related to academic achievement or academic performance and 9.52% was about emotional intelligence. Furthermore, 7.14% of articles focused on self-efficacy and problem-solving learning variables separately. Moreover, 4.76% of articles investigated achievement goal orientation, information literacy, self-esteem, team-based learning, meta-cognitive, self-directed learning, learning styles, and clinical decision-making variables and 2.38% explored occupational

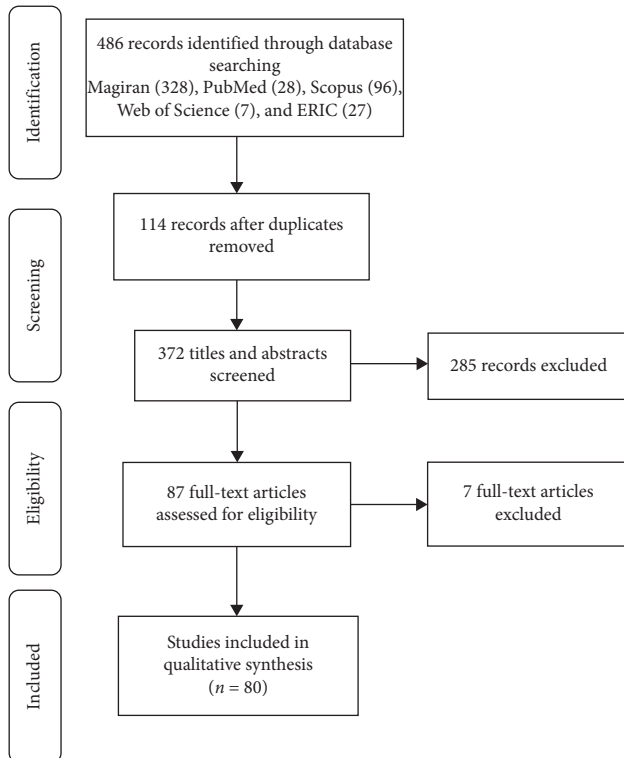


FIGURE 1: Flowchart of the selection and reviewing of studies.

therapy, team-based learning, information communication technology, mental health, metacognitive, conflict management styles, creativity, entrepreneurial characteristics, decision-making ability, metacognitive, flipped classroom, teaching quality, evidence-based education, blended learning, clinical decision-making skills, personality traits, thinking style, interpersonal communication skills, learning styles, assertiveness, active educational method, stress coping strategies, motivation, intentional Internet search behavior, collaborative and individual method, clinical decision-making, and reflection on clinical journalism variables.

The results of the second and third questions in the present study showed that students had poor critical thinking skills in 48 articles. They had average critical thinking skills in 2 articles and high critical thinking skills in only one article. Considering the disposition to critical thinking, in 13 articles, the disposition was low or ambivalence, 11 had moderate disposition, and in 5 studies, the disposition was high or positive (Table 1).

4. Discussion

Based on the results of this systematic review, the level of critical thinking skills of medical sciences students in most studies was low. In other countries, studies were also conducted to measure students' critical thinking. In this regard, the results of a study in the United States (2009) indicated that the degree of critical thinking skills in pharmaceutical students was at a desirable and above average level [108]. In another study (2004), the level of critical thinking skills in

physiotherapy students in Canada was evaluated at a desirable and above average level [109]. Critical thinking skills in nursing students were reported higher than that of the study conducted [110] in Australia (2014).

Regarding the low score of critical thinking skills in Iranian students compared to students from other countries, we believe that the educational system of Iran does not consider enhancing the critical thinking in students. Thus, the promotion of critical thinking skills in students nowadays is one of the most important challenges faced by medical teachers and educational planners [111].

Since critical thinking can be taught to students, in curriculum design, teaching critical thinking to students should be considered as a priority. To enhance students' critical thinking in the higher education curriculum, the higher levels of Bloom's cognitive domain, including analysis, synthesis, and evaluation, should be highlighted [112, 113]. In order to develop critical thinking skills within the framework of medical education curriculum, appropriate teaching methods should be used that are consistent with the nature of critical thinking. In this regard, moving from teacher-centered models to student-centered models is one of the most important principles that should be considered for the teaching of critical thinking. Also, designing a classroom environment to create a challenging dialogue between class members, encouraging learners to participate in class discussions, moving toward problem-based learning, and using active learning strategies in critical thinking education is effective [114–116].

Regarding the disposition to think critically in students, in most studies, critical thinking was at a low and moderate level. The results of a study (2016) in nursing students in Turkey indicated that the students' disposition to think critically was at a low level [11]. The results of another study (2018) conducted in Ireland suggest that the rate of critical thinking disposition in first year nursing students was more than that of third year students [117]. Another study (2019) on medical students in China indicated that critical thinking disposition in students was at a positive level [118]. The results of another study (2015) in medical students in China indicated a positive attitude toward critical thinking [119].

In the critical thinking disposition, attention is paid to the individual's attitude and intension and various issues and topics and thinking about them. It is believed that, without critical thinking disposition, critical thinking skills cannot be developed [25]. Also, having critical thinking skills does not guarantee critical thinking disposition, and those with critical thinking disposition do not necessarily have the skills to think critically. Therefore, the subject of critical thinking should be taken into account, as well as critical thinking skills and its significance must be fully understood [120]. We believe that critical thinking disposition and critical thinking skills are interdependent. Having critical thinking skills is useless without critical thinking disposition and cannot in practice be used by students. Moreover, if students are inclined to think critically in an educational system, but educational, technological, and cultural infrastructures are unavailable, the disposition to think critically will be reduced after some time.

TABLE 1: Features of the studies reviewed about critical thinking in Iranian medical sciences students.

Author name (YP)	Title	Method	Sample	Sampling method	Instrument	Result
Shakurnia and Baniasad (2018) [32]	Critical thinking disposition in the first and last year medical students and its association with achievement goal orientation	Cross-sectional	N = 204 Female: 68%	Census	The Ricketts critical thinking disposition scale	Low level
YektaKooshali et al. (2018) [33]	The relationship between information literacy with critical thinking among students: a cross-sectional study	Cross-sectional analytic	N = 165 Female: 74.5%	Stratified Random	California Critical Thinking Skills Test, Form B (CCTST, FB)	Low level
Heidari Gorji et al. (2018) [34]	Path analysis of self-efficacy, critical thinking skills, and emotional intelligence for mental health of medical students	Cross-sectional	N = 480 Female: 42%	Random	California Critical Thinking Skills Test, Form B (CCTST, FB)	Low level
Hasanpour et al. (2018) [35]	The relationship between emotional intelligence and critical thinking skills in Iranian nursing students	Cross-sectional correlative	N = 169 Female: 64.5%	Systematic Random	California Critical Thinking Skills Test, Form B (CCTST, FB)	Low level
Rashidi Fakari et al. (2018) [36]	The relationship between critical thinking disposition and self-esteem in midwifery students	Cross-sectional	N = 53	Census	California Critical Thinking Disposition Inventory (CCTDI)	Ambivalent
Taheri et al. (2017) [37]	Surveying critical thinking dispositions between freshmen and senior students in school of allied medical sciences in 2012-2013 academic year	Cross-sectional	N = 90 Female: 75%	Cluster random	The Ricketts critical thinking disposition scale	Moderate level
Mobasheri et al. (2017) [38]	Critical thinking skills among bachelor students at Fasa University of Medical Sciences	Cross-sectional analytical	N = 150 Female: 71.3%	Stratified random	California Critical Thinking Skills Test, Form B (CCTST, FB)	Low level
Jafarzadeh et al (2017) [39]	Comparison critical thinking skills among medical and paramedical students in Fasa University of Medical Science	Cross-sectional analytic	N = 231 Female: 62.3%	Stratified random	California Critical Thinking Skills Test, Form B (CCTST, FB)	Low level
Maleki et al. (2016) [40]	Occupational therapy BSc students' critical thinking skills at Shahid Beheshti University of Medical Sciences, Tehran	Cross-sectional analytic	N = 72 Female: 70.8%	Census	California Critical Thinking Skills Test, Form B (CCTST, FB)	Low level
Raeisoon et al. (2017) [41]	Comparing skills of critical thinking and happiness among students of faculty of medial sciences and other universities of Ghaen	Cross-sectional analytic	N = 163 Female: 33.2%	Cluster random	The Ricketts critical thinking disposition scale	Higher than moderate level

TABLE 1: Continued.

Author name (YP)	Title	Method	Sample	Sampling method	Instrument	Result
Kuhpayehzadeh Isfahani et al. (2017) [42]	The effect of team-based learning on critical thinking of nursing students at Iran University of Medical Sciences	Quasiexperimental	N = 80 Female: 56%	Random	Watson–Glaser Critical Thinking Appraisal (WGCTA)	High level
Adib-Hajbaghery and Zare (2017) [31]	Effect of educational workshop on improving the critical thinking skills in nursing student	Quasiexperimental	N = 32 Female: 62.5%	Census	California Critical Thinking Skills Test, Form B (CCTST, FB)	Low level
Shakurnia and Aslami (2017) [43]	Critical thinking skills of medical students at Ahvaz Jundishapur University of Medical Sciences	Cross-sectional	N = 181 Female: 54.5%	Convenience	California Critical Thinking Skills Test, Form B (CCTST, FB)	Low level
Zarabian et al. (2016) [44]	Study of critical thinking disposition in virtual graduated students (Tehran University of Medical Sciences)	Cross-sectional	N = 100 Female: 44%	Stratified random	California Critical Thinking Disposition Inventory (CCTDI)	Moderate level
Askari et al.(2016) [45]	Critical thinking skills among healthcare management college students: a case study in Iran, a study conducted in 2016	Cross-sectional	N = 90 Female: 80%	Census	California Critical Thinking Skills Test, Form B (CCTST, FB)	Moderate level
Darban et al (2016) [46]	Evaluation of critical thinking skills among medical sciences students in Shahid Beheshti and Tehran University of Medical Sciences	Cross-sectional	N = 60 Female: 60%	—	California Critical Thinking Skills Test, Form B (CCTST, FB)	Low level
Maleki and Sanisales (2016) [47]	Regarding the use of ICT with critical thinking (case study, Shahrkoord University of Medical Sciences)	Cross-sectional correlational	N = 130	Convenience	The Ricketts critical thinking disposition scale	Low level
Mousazadeh et al. (2016) [48]	Nursing students' disposition toward critical thinking and its relationship with their academic performance	Cross-sectional correlational	N = 120 Female: 57.1%	Convenience	The Ricketts critical thinking disposition scale	Higher than moderate level
Shabouni et al. (2016) [49]	The effect of team-based learning in medical information systems course on academic achievement and critical thinking in postgraduate students of Kerman University of Medical Sciences, Iran	Quasiexperimental	N = 60 Female: 60.0%	Census	California Critical Thinking Disposition Inventory (CCTDI)	Ambivalent
Moslemi et al. (2016) [50]	The relationship between critical thinking skills with mental health and academic achievement of Qom University of Medical Sciences students	Cross-sectional correlation	N = 208 Female: 72.6%	Stratified random	California Critical Thinking Skills Test, Form B (CCTST, FB)	Low level

TABLE 1: Continued.

Author name (YP)	Title	Method	Sample	Sampling method	Instrument	Result
Gholamrezai et al. (2016) [51]	The predictive role of self-efficacy and metacognitive on students tendency to critical thinking	Cross-sectional correlation	N = 220 Female: 60.9%	Cluster random	The Ricketts critical thinking disposition scale	Moderate level
Hasanpour et al. (2016) [52]	Relationship between nurses' conflict management styles and critical thinking skills in the clinical setting	Cross-sectional correlation	N = 337 Female: 69%	Census	California Critical Thinking Skills Test, Form B (CCTST, FB)	Low level
Mohammadi et al. (2016) [53]	The relationship between critical thinking skills with creativity and academic achievement in students Qom University of Medical Sciences	Cross-sectional correlation	N = 303 Female: 72.6%	Stratified random	California Critical Thinking Skills Test, Form B (CCTST, FB)	Low level
Azami and Salehiniya (2016) [54]	The relationship between critical thinking and information literacy among students of the school of management and medical information sciences of Tehran University of Medical Sciences, Iran	Cross-sectional analytic	N = 338 Female: 59.8%	Random	California Critical Thinking Skills Test, Form B (CCTST, FB)	Low level
Azizi et al. (2016) [55]	The correlation of critical thinking disposition and achievement goal orientation with student entrepreneurial characteristics	Cross-sectional analytic	N = 307 Female: 51%	Stratified random	The Ricketts critical thinking disposition scale	Moderate level
Heidari and Ebrahimi (2016) [15]	Examining the relationship between critical thinking skills and decision-making ability of emergency medicine students	Cross-sectional analytic	N = 86	Census	California Critical Thinking Skills Test, Form B (CCTST, FB)	Low level
Mafakheri Laleh et al. (2016) [10]	Designing a model for critical thinking development in AJA University of Medical Sciences	Cross-sectional	N = 257 Female: 83%	Stratified random	The Ricketts critical thinking disposition scale	Moderate level
Gholami et al. (2016) [56]	Comparing the effects of problem-based learning and the traditional lecture method on critical thinking skills and metacognitive awareness in nursing students in a critical care nursing course	Quasiexperimental	N = 40 Female: 62.5%	Census	California Critical Thinking Skills Test, Form B (CCTST, FB)	Low level
Dehghanzadeh and Jafaraghaee (2016) [57]	Comparing the effects of traditional lecture and flipped classroom on nursing students' critical thinking disposition	Quasiexperimental	N = 85 Female: 83.5%	Census	The Ricketts critical thinking disposition scale	Moderate level

TABLE 1: Continued.

Author name (YP)	Title	Method	Sample	Sampling method	Instrument	Result
Ajam (2015) [58]	The role of self-directed learning readiness and critical thinking disposition in students' interaction in blended learning environment	Cross-sectional	N = 260 Female: 70.4%	Stratified random	The Ricketts critical thinking disposition scale	Moderate level
Salehi et al. (2015) [59]	Comparison between "problem-based learning" and "question and answer" educational methods on environmental health students' attitude to critical thinking	Quasiexperimental	N = 27 Female: 100%	Census	California Critical Thinking Disposition Inventory (CCTDI)	Positive
Azizi-Fini et al. (2015) [60]	Critical thinking skills in nursing students: a comparison between freshmen and senior students	Cross-sectional comparative	N = 150	Census	California Critical Thinking Skills Test, Form B (CCTST, FB)	Low level
Tanhaye Reshvanlou et al. (2015) [61]	Role of professor's teaching quality on the trend of health students to critical thinking	Cross-sectional correlation	N = 109 Female: 47.7%	Convenience	California Critical Thinking Disposition Inventory (CCTDI)	Ambivalent
Tafazzoli et al. (2016) [62]	The relationship between critical thinking dispositions and academic achievement in Iranian midwifery students	Cross-sectional correlation	N = 60 Female: 100.0%	Census	California Critical Thinking Disposition Inventory (CCTDI)	Ambivalent
Poodineh Moghadam et al. (2015) [63]	The impact of evidence-based education on nursing students' critical thinking	Quasiexperimental	N = 43 Female: 60.5%	Census	California Critical Thinking Skills Test, Form B (CCTST, FB)	Low level
Hasanpour et al. (2015) [64]	Critical thinking skills of nursing students	Cross-sectional	N = 169 Female: 64%	Stratified random	California Critical Thinking Skills Test, Form B (CCTST, FB)	Low level
Hajrezayi et al. (2015) [65]	Effectiveness of blended learning on critical thinking skills of nursing students	Quasiexperimental	N = 61 Female: 63.9%	Convenience	California Critical Thinking Skills Test, Form B (CCTST, FB)	Low level
Vahedi et al. (2015) [66]	The relationship between emotional intelligence and critical thinking in nursing students of Tabriz University of Medical Sciences	Cross-sectional correlation	N = 200 Female: 50%	Random	California Critical Thinking Skills Test, Form B (CCTST, FB)	Low level
Rezaeian et al. (2015) [67]	Comparison of the critical thinking skills among medical students in different educational levels in Rafsanjan University of Medical Sciences	Cross-sectional	N = 165 Female: 39.4%	—	The Ricketts critical thinking disposition scale	Moderate level
Penjvini and Hejrani (2015) [68]	Critical thinking and clinical decision-making skills in pediatric nursing students	Cross-sectional correlation	N = 34	Census	Watson-Glaser Critical Thinking Appraisal (WGCTA)	Low level

TABLE 1: Continued.

Author name (YP)	Title	Method	Sample	Sampling method	Instrument	Result
Ghaedi and Toghiann (2014) [69]	Correlation between personality traits of critical thinking in nursing students of Isfahan University of Medical Sciences	Cross-sectional correlation	N = 165 Female: 56.4%	Cluster random	California Critical Thinking Skills Test, Form B (CCTST, FB)	Low level
Garavand et al. (2014) [70]	The role functions of thinking style in self-directed learning readiness and critical thinking disposition	Causal-comparative	N = 214 Female: 73%	Stratified random	The Ricketts critical thinking disposition scale	Moderate level
Shahjooi et al. (2014) [71]	Relationship between critical thinking and interpersonal communication skills in nursing students of Azad University Tehran medical branch	Cross-sectional correlation	N = 300	Census	California Critical Thinking Disposition Inventory (CCTDI)	Ambivalent
Noohi et al. (2014) [72]	Association of critical thinking with learning styles in nursing students of School of Nursing and Midwifery, Iran.	Cross-sectional correlation	N = 90 Female: 70.7%	Purposive	California Critical Thinking Skills Test, Form B (CCTST, FB)	Low level
Taghavi Larijani et al. (2014) [73]	Relationship between assertiveness and critical thinking in nursing students	Cross-sectional correlation	N = 225 Female: 85.9%	Convenience	California Critical Thinking Skills Test, Form B (CCTST, FB)	Low level
Yasayi et al. (2014) [74]	Critical thinking skills among dental students of Shahid Sadoughi University of Medical Sciences: A comparison in 2013	Cross-sectional	N = 64 Female: 60.9%	Census	California Critical Thinking Skills Test, Form B (CCTST, FB)	Low level
Hemmati Maslak Pak et al. (2014) [75]	The effect of problem-based learning training on nursing students' critical thinking skills	Quasiexperimental	N = 50 Female: 62%	Census	California Critical Thinking Skills Test, Form B (CCTST, FB)	Low level
Hosseini et al. (2014) [76]	The effect of an active educational method on critical thinking of nursing students in Lorestan University of Medical Sciences	Quasiexperimental	N = 60 Female: 78.3%	Convenience	California Critical Thinking Skills Test, Form B (CCTST, FB)	Low level
Rezaei et al. (2014) [77]	Evaluation of nursing students, critical thinking skills in Mazandaran University of Medical Sciences	Cross-sectional analytic	N = 245 Female: 55.8%	Census	Watson-Glaser critical thinking test	Low level
Khazaei et al. (2014) [78]	Compared critical thinking in first year students and senior operating room and anesthesia Birjand University of Medical Sciences	Cross-sectional	N = 120 Female: 62.5%	Convenience	California Critical Thinking Skills Test, Form B (CCTST, FB)	Low level

TABLE 1: Continued.

Author name (YP)	Title	Method	Sample	Sampling method	Instrument	Result
Najafianzadeh et al. (2014) [79]	Critical thinking skills and their association with stress coping strategies in the students of Arak University of Medical Sciences, Iran	Cross-sectional analytic	N = 100 Female: 64%	Stratified random	Watson–Glaser Critical Thinking Appraisal (WGCTA)	Low level
Ghazivakili et al. (2014) [80]	The role of critical thinking skills and learning styles of university students in their academic performance	Cross-sectional correlation	N = 216 Female: 52.8%	Stratified random	California Critical Thinking Skills Test, Form B (CCTST, FB)	Low level
Ghadampour et al. (2013) [81]	Learning style priorities and its role in critical thinking disposition among nursing school students in Mashhad University of Medical Sciences	Cross-sectional	N = 214 Female: 74.3%	Stratified random	The Ricketts critical thinking disposition scale	Moderate level
Karimi Noghondar et al. (2013) [82]	Comparison of critical thinking and clinical decision-making skills among the last semester nursing students and practicing nurses in Sabzevar University of Medical Sciences	Cross-sectional	N = 35 Female: 41.8%	Random	California Critical Thinking Skills Test, Form B (CCTST, FB)	Low level
Meibodi et al. (2013) [83]	Impact of guided reciprocal peer questioning on the disposition of critical thinking among nursing students	Quasiexperimental	N = 54	—	California Critical Thinking Disposition Inventory (CCTDI)	Ambivalent
Sabouri Kashani et al. (2013) [84]	Critical thinking dispositions among medical students in two stages: basic medical sciences and preinternship	Cross-sectional	N = 442 Female: 57.2%	Census	California Critical Thinking Disposition Inventory (CCTDI)	Positive inclination
Sheikhmoonesi et al. (2013) [85]	Critical thinking abilities among students of medicine in Mazandaran University of Medical Sciences, 2011	Cross-sectional	N = 118 Female: 42.3%	Cluster random	California Critical Thinking Skills Test, Form B (CCTST, FB)	Low level
Tashi et al. (2013) [86]	Evaluating critical thinking skills in medical students, Isfahan University of Medical Sciences, Iran	Cross-sectional	N = 92 Female: 59.8%	Census	California Critical Thinking Skills Test, Form B (CCTST, FB)	Low level
Abasi et al. (2013) [87]	Critical thinking disposition and its relationship with self-esteem in preclinical and clinical medical students of Kermanshah University of Medical Sciences	Cross-sectional analytic	N = 225 Female: 85.8%	Stratified random	California Critical Thinking Disposition Inventory (CCTDI)	Ambivalent

TABLE 1: Continued.

Author name (YP)	Title	Method	Sample	Sampling method	Instrument	Result
Athari et al. (2013) [21]	Assessing critical thinking in medical sciences students in two sequential semesters: Does it improve?	Longitudinal	N = 297	Random	California Critical Thinking Skills Test, Form B (CCTST, FB)	Low level
Kermansaravi et al. (2013) [88]	Critical thinking dispositions among junior, senior, and graduate nursing students in Iran	Cross-sectional	N = 120 Female: 62.1%	Stratified random	Watson-Glaser Critical Thinking Appraisal (WGCTA)	Low level
Gupta et al. (2012) [89]	Validly and reliability of California Critical Thinking Disposition Inventory (CCTDI) in Kermanshah University of Medical Sciences	Cross-sectional analytic	N = 198 Female: 82.8%	—	California Critical Thinking Disposition Inventory (CCTDI)	Ambivalent
Hariri and Bagherinejad (2012) [90]	Analysis of the relationship between motivation and critical thinking with intentional internet search behavior case study: students of Mazandaran University of Medical Sciences	Cross-sectional analytic	N = 224 Female: 58.5%	Stratified random	California Critical Thinking Skills Test, Form B (CCTST, FB)	Low level
Nasrabadi and Mousavi (2012) [91]	The contribution of critical thinking attitude and cognitive learning styles in predicting academic achievement of medical university's students	Cross-sectional analytic	N = 161 Female: 50.31%	Stratified random	California Critical Thinking Disposition Inventory (CCTDI)	Moderate level
Mahmoodabad et al. (2012) [92]	Critical thinking ability and its associated factors among preclinical students in Yazd Shaheed Sadoughi University of Medical Sciences (Iran)	Cross-sectional	N = 125 Female: 66.4%	Cluster random	Watson-Glaser Critical Thinking Appraisal (WGCTA)	Low level
Iranfar et al. (2012) [93]	Developing critical thinking disposition in the students of nursing and midwifery through collaborative and individual methods of learning	Quasiexperimental	N = 115 Female: 83%	Random	California Critical Thinking Disposition Inventory (CCTDI)	Ambivalent
Safari et al. (2012) [94]	The comparison between critical thinking disposition of teachers and students in Kermanshah University of Medical Sciences, 2011	Cross-sectional analytic	N = 300 Female: 60.7%	Stratified random	The Ricketts critical thinking disposition scale	Low level
Paryad et al. (2011) [95]	Relationship between critical thinking and clinical decision-making in nursing students	Cross-sectional correlation	N = 50	Census	California Critical Thinking Skills Test, Form B (CCTST, FB)	Low level

TABLE 1: Continued.

Author name (YP)	Title	Method	Sample	Sampling method	Instrument	Result
Khodamoradi et al. (2011) [96]	Comparing critical thinking skills of first and last term baccalaureate students of nursing, midwifery, and occupational therapy of medical universities of Tehran city	Cross-sectional	N = 426	Census	California Critical Thinking Skills Test, Form B (CCTST, FB)	Low level
Kareshki and Pakmehr (2011) [97]	The relationship between self-efficacy beliefs, metacognitive, and critical thinking with mental health in medical sciences students	Cross-sectional	N = 357 Female: 55%	Cluster random	California Critical Thinking Skills Test, Form B (CCTST, FB)	Low level
Haghani et al. (2011) [98]	Critical thinking skills and their relationship with emotional intelligence in medical students of introductory clinical medicine (ICM) course in Isfahan University of Medical Sciences	Cross-sectional	N = 69 Female: 72%	Census	California Critical Thinking Skills Test, Form B (CCTST, FB)	Low level
Kiany et al. (2012) [99]	Comparison of critical thinking skills and dispositions between the nursing students and clinical nurses of selected educational hospitals of Zanjan University of Medical Sciences	Cross-sectional	N = 100 Female: 63.4%	Convenience	California Critical Thinking Skills Test, Form B (CCTST, FB)	Low level
Barkhordary et al. (2011) [100]	Critical thinking dispositions in baccalaureate nursing students of Shahid Sadooghi and Azad University of Medical Sciences in Yazd city	Cross-sectional	N = 170 Female: 89.4%	Random	California Critical Thinking Disposition Inventory (CCTDI)	Ambivalent
Eslami Akbar and Maarefi (2010) [101]	A comparison of the critical thinking ability in the first and last term baccalaureate students of nursing and clinical nurses of Jahrom University of Medical Sciences	Cross-sectional	N = 94 Female: 82.1%	Census	Watson-Glaser Critical Thinking Appraisal (WGCTA)	Low level
Dehghani et al. (2011) [102]	The effect of reflection on clinical journalism on critical thinking skills of nursing students in Shiraz Medical University	Quasiexperimental	N = 42 Female: 83.33%	-	California Critical Thinking Skills Test, Form B (CCTST, FB)	Low level
Athari et al. (2009) [103]	Evaluation of critical thinking skills in Isfahan University of Medical Sciences' students and its relationship with their rank in university entrance exam rank	Cross-sectional	N = 114	Random	California Critical Thinking Skills Test, Form B (CCTST, FB)	Low level

TABLE 1: Continued.

Author name (YP)	Title	Method	Sample	Sampling method	Instrument	Result
Gharib et al. (2009) [104]	Critical thinking skills and critical thinking dispositions in freshmen and senior students of healthcare management	Cross-sectional	N = 60	—	California Critical Thinking Skills Test, Form B (CCTST, FB) and California Critical Thinking Disposition Inventory (CCTDI)	Skills: norm Dispositions: positive inclination
Karimi et al. (2007) [105]	The critical thinking skills levels of students enrolled in a four years bachelor program at nursing college in Yasouj	Cross-sectional	N = 72 Female: 72.2%	Convenience	California Critical Thinking Skills Test, Form B (CCTST, FB)	Low level
Baba Mohammadi and Khalili (2004) [106]	Critical thinking skills of nursing students in Semnan University of Medical Sciences	Cross-sectional	N = 107	Census	California Critical Thinking Skills Test, Form B (CCTST, FB)	Low level
Mirmolaei et al. (2004) [107]	Comparison of critical thinking among first and last trimester baccalaureate midwifery students	Cross-sectional comparative	N = 259	Census	California Critical Thinking Skills Test, Form B (CCTST, FB)	Low level

TABLE 2: Features of materials and methods in studies.

Materials and methods	Frequency (%)	
	Census	27 (35.75%)
	Convenience	10 (12.50%)
	Random	8 (10.00%)
Study method	Stratified random	19 (23.75%)
	Systematic random	1 (1.25%)
	Cluster random	7 (8.75%)
	Purposive	1 (1.25%)
	No sampling	7 (8.75%)
Sampling method	Cross-sectional	65 (81.25%)
	Quasiexperimental	13 (16.25%)
	Longitudinal	1 (1.25%)
	Causal-comparative	1 (1.25%)
Measuring tools	Ricketts critical thinking disposition scale	14 (48.27%)
	The California Critical Thinking Disposition Inventory (CCTDI)	15 (51.72%)
	The California Critical Thinking Skills Test, Form B (CCTST, FB)	46 (90.20%)
	The Watson–Glaser Critical Thinking Appraisal (WGCTA)	5 (9.80%)

The results of studies conducted in Iran about critical thinking indicate that researchers use four major tools more than other tools to measure skills and tendency to critical thinking. These tools include Ricketts critical thinking disposition, California Critical Thinking Disposition Inventory, the California Critical Thinking Skills Test, and the Watson–Glaser Critical Thinking Appraisal. In studies with a quantitative approach, a questionnaire is the most important data collection tool. Hence, psychometric indices, number of questionnaire items, response time, and compatibility with sociocultural characteristics of respondents should be taken into account in choosing the measurement tools. Researchers should use the qualitative approach and

semistructured interviews for accurate diagnosis of critical thinking skills and the tendency to think critically.

Regarding the promotion of critical thinking in health sciences students in Iran, it can be stated that curriculum elements including the objective, learning content, teaching methods, learning activities, and learning assessment should be designed in a way to facilitate the process of critical thinking. The structure and process of teaching-learning in the classroom should be such that the teacher plays the role of facilitator and gives students the opportunity to express their opinion. Learners should be involved in the learning process and have the greatest role and responsibility in their learning. In addition to the role of educational factors, the sociocultural conditions and characteristics of a society are

also influential in the critical thinking of members of a community, including students. In one sentence can state that the critical thinking spirit must be rooted in socio-cultural structures of a community.

The present study confronted with some limitations. There might be some studies conducted in line with the purpose of the present study, which, due to nonpublication, was not included in this study. Also, in our study, we studied only studies published in Persian and English, and studies in other languages could not be considered due to language constraints. In the current study, the studies differed in terms of quality, which could affect the accuracy of the results. Nonuniform reporting of articles is another limitation of the present study. The present study, like many qualitative studies, sought to establish a deep understanding of a subject. Therefore, the most important strength of the present study was to explain the current level of critical thinking skills and the tendency to think critically in students of health professions in Iran. Another strength of this study is the identification of variables related to critical thinking. Therefore, in future studies, researchers can more closely examine the relationship between these variables and critical thinking. The findings of this study alone are not sufficient for planning and making major decisions about critical thinking in health students. However, according to the results of studies on critical thinking in Iranian students, as well as the results of the current study, it is possible to plan and decide to promote critical thinking in students.

5. Conclusion

In this systematic review, the rate of critical thinking of medical sciences students in Iran was studied. The amount of critical thinking was identified in two aspects of critical thinking skills and critical thinking disposition. The results indicated that critical thinking skills in medical sciences students in Iran were low. Students' disposition to think critically was also moderate and low. Thus, considering the importance and necessity of critical thinking for medical sciences students, future studies should focus on studying and identifying effective factors in promoting critical thinking in students. Considering that critical thinking can be taught, it is beneficial to hold workshops and critical thinking training courses.

Data Availability

The identified datasets analyzed during the current study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that there are no conflicts of interest.

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References

- [1] D. Pnevmatikos, P. Christodoulou, and T. Georgiadou, "Promoting critical thinking in higher education through the values and knowledge education (VaKE) method," *Studies in Higher Education*, vol. 44, no. 5, pp. 892–901, 2019.
- [2] D. F. Halpern, *Thought and Knowledge: An Introduction to Critical Thinking*, Psychology Press, Hove, UK, 2013.
- [3] C. Troussas, A. Krouska, and C. Sgouropoulou, "Collaboration and fuzzy-modeled personalization for mobile game-based learning in higher education," *Computers & Education*, vol. 144, Article ID 103698, 2020.
- [4] Z. C. Y. Chan, "Nursing students' view of critical thinking as "own thinking, searching for truth, and cultural influences"" *Nurse Education Today*, vol. 78, pp. 14–18, 2019.
- [5] L. V. Morris, "Moving beyond critical thinking to critical dialogue," *Innovative Higher Education*, vol. 42, no. 5-6, pp. 377–378, 2017.
- [6] W. M. Daly, "The development of an alternative method in the assessment of critical thinking as an outcome of nursing education," *Journal of Advanced Nursing*, vol. 36, no. 1, pp. 120–130, 2001.
- [7] R.-C. Feng, M.-J. Chen, M.-C. Chen, and Y.-C. Pai, "Critical thinking competence and disposition of clinical nurses in a medical center," *Journal of Nursing Research*, vol. 18, no. 2, pp. 77–87, 2010.
- [8] J. E. Dowd, R. J. Thompson, L. A. Schiff, and J. A. Reynolds, "Understanding the complex relationship between critical thinking and science reasoning among undergraduate thesis writers," *CBE Life Sciences Education*, vol. 17, no. 1, pp. 1–10, 2018.
- [9] Z. C. Y. Chan, "A systematic review on critical thinking in medical education," *International Journal of Adolescent Medicine and Health*, vol. 30, no. 1, 2016.
- [10] M. M. Laleh, M. Mohammadimehr, and S. Z. B. Jame, "Designing a model for critical thinking development in AJA University of Medical Sciences," *Journal of Advances in Medical Education & Professionalism*, vol. 4, no. 4, p. 179, 2016.
- [11] H. Kaya, E. Şenyuva, and G. Bodur, "Developing critical thinking disposition and emotional intelligence of nursing students: a longitudinal research," *Nurse Education Today*, vol. 48, pp. 72–77, 2017.
- [12] E. Zuriguel-Pérez, A. Falcó-Pegueroles, S. Agustino-Rodríguez, M. d. C. Gómez-Martín, J. Roldán-Merino, and M. T. Lluch-Canut, "Clinical nurses's critical thinking level according to sociodemographic and professional variables (phase II): a correlational study," *Nurse Education in Practice*, vol. 41, Article ID 102649, 2019.
- [13] J. M. Spector and S. Ma, "Inquiry and critical thinking skills for the next generation: from artificial intelligence back to human intelligence," *Smart Learning Environments*, vol. 6, no. 1, p. 8, 2019.
- [14] C. P. Dwyer, M. J. Hogan, and I. Stewart, "An integrated critical thinking framework for the 21st century," *Thinking Skills and Creativity*, vol. 12, pp. 43–52, 2014.
- [15] M. Heidari and P. Ebrahimi, "Examining the relationship between critical-thinking skills and decision-making ability of emergency medicine students," *Indian Journal of Critical Care Medicine*, vol. 20, no. 10, pp. 581–586, 2016.

- [16] H. A. Gloude-mans, R. M. J. D. Schalk, and W. Reynaert, "The relationship between critical thinking skills and self-efficacy beliefs in mental health nurses," *Nurse Education Today*, vol. 33, no. 3, pp. 275–280, 2013.
- [17] V. Pitt, D. Powis, T. Levett-Jones, and S. Hunter, "The influence of critical thinking skills on performance and progression in a pre-registration nursing program," *Nurse Education Today*, vol. 35, no. 1, pp. 125–131, 2015.
- [18] Y. Kanbay and A. Okanlı, "The effect of critical thinking education on nursing students' problem-solving skills," *Contemporary Nurse*, vol. 53, no. 3, pp. 313–321, 2017.
- [19] C. M. Walsh, L. A. Seldomridge, and K. K. Badros, "California critical thinking disposition inventory: further factor analytic examination," *Perceptual and Motor Skills*, vol. 104, no. 1, pp. 141–151, 2007.
- [20] P. Facione and N. Facione, *The California Critical Thinking Dispositions Inventory (CCTDI); and CCTDI Test Manual*, California Academic Press, Millbrae, CA, USA, 1992.
- [21] Z.-S. Athari, S.-M. Sharif, A. R. Nasr, and M. Nematbakhsh, "Assessing critical thinking in medical sciences students in two sequential semesters: does it improve?" *Journal of Education and Health Promotion*, vol. 2, 2013.
- [22] E. M. Whitney, J. Aleksejuniene, and J. N. Walton, "Critical thinking disposition and skills in dental students: development and relationship to academic outcomes," *Journal of Dental Education*, vol. 80, no. 8, pp. 948–958, 2016.
- [23] C. A. Giancarlo and P. A. Facione, "A look across four years at the disposition toward critical thinking among undergraduate students," *The Journal of General Education*, vol. 50, no. 1, pp. 29–55, 2001.
- [24] J. C. Ricketts, "The efficacy of leadership development, critical thinking dispositions, and student academic performance on the critical thinking skills of selected youth leaders," Doctoral dissertation, University of Florida, Gainesville, FL, USA, 2003.
- [25] J. Profetto-McGrath, "The relationship of critical thinking skills and critical thinking dispositions of baccalaureate nursing students," *Journal of Advanced Nursing*, vol. 43, no. 6, pp. 569–577, 2003.
- [26] J.-A. Park and B.-J. Kim, "Critical thinking disposition and clinical competence in general hospital nurses," *Journal of Korean Academy of Nursing*, vol. 39, no. 6, 2009.
- [27] T. Sulaiman, S. K. Kuppusamy, A. F. M. Ayub, and S. S. A. Rahim, "Relationship between critical thinking disposition and teaching efficacy among special education integration program teachers in Malaysia," *AIP Conference Proceedings*, Vol. 1795, AIP Publishing LLC, Long Island, NY, USA, 2017.
- [28] S. Arslan and Z. Demirtas, "Social emotional learning and critical thinking disposition," *Studia Psychologica*, vol. 58, no. 4, p. 276, 2016.
- [29] C. Şahin and H. Kumcağız, "The relationship between critical thinking disposition, problem solving and empathetic tendency in counsellor candidates," *SHS Web of Conferences*, vol. 37, 2017.
- [30] R. Demirtas, M. J. Álvarez-Pasquin, C. Díaz, J. L. Del Barrio, J. M. Estrada, and Á. Gil, "Are healthcare workers' intentions to vaccinate related to their knowledge, beliefs and attitudes? A systematic review," *BMC Public Health*, vol. 13, no. 1, p. 154, 2013.
- [31] M. Adib-Hajbaghery and M. Zare, "The barriers to patient education from the viewpoint of nurses in Iran: a systematic review," *Journal of Urmia Nursing and Midwifery Faculty*, vol. 15, no. 7, pp. 544–558, 2017.
- [32] A. Shakurnia and M. Baniasad, "Critical thinking disposition in the first-and last-year medical students and its association with achievement goal orientation," *Strides in Development of Medical Education*, vol. 15, no. 1, 2018.
- [33] M. H. YektaKooshali, A. Ramezani, S. PourNajafi, and M. Esmailpour-BandBoni, "The relationship between information literacy with critical thinking among students: a cross-sectional study," *Journal of Nursing Education*, vol. 6, no. 5, pp. 1–8, 2017.
- [34] A. M. Heidari Gorji, M. Shafizad, A. Soleimani, M. Darabinia, and A. Hossein, "Path analysis of self-efficacy, critical thinking skills and emotional intelligence for mental health of medical students," *Iranian Journal of Psychiatry and Behavioral Sciences*, vol. 12, no. 4, 2018.
- [35] M. Hasanpour, M. Bagheri, and F. G. Heidari, "The relationship between emotional intelligence and critical thinking skills in Iranian nursing students," *Medical Journal of the Islamic Republic of Iran*, vol. 32, p. 40, 2018.
- [36] F. Rashidi Fakari, M. Tafazoli, and S. Dadgar, "The relationship between critical thinking disposition and self-esteem in midwifery students," *Strides in Development of Medical Education*, vol. 15, no. 1, pp. 15–20, 2018.
- [37] A. Taheri, F. Azadeh, M. Moradi-Joo, and O. Yousefianzadeh, "Surveying critical thinking dispositions between freshmen and senior students in school of allied medical sciences in 2012-2013 academic year," *Payavard Salamat*, vol. 11, no. 3, pp. 1–9, 2017.
- [38] F. Mobasheri, M. Manoochehri, and F. Noruzi, "Critical thinking skills among bachelor students at Fasa University of Medical Sciences," *Development Strategies in Medical Education*, vol. 4, no. 1, pp. 4–15, 2017.
- [39] S. Jafarzadeh, Z. Akbarzadeh, and F. Mobasheri, "Comparison critical thinking skills among medical and paramedical students in Fasa University of Medical Science," *Journal of Medical Education and Development*, vol. 12, no. 1, pp. 87–99, 2017.
- [40] Z. Maleki, M. Rezaee, N. Mirzakhani, Z. Shafiee, and S. M. Tabatabaee, "Occupational therapy BSc students' critical thinking skills at Shahid Beheshti University of Medical Sciences, Tehran," *The Scientific Journal of Rehabilitation Medicine*, vol. 5, no. 4, pp. 84–93, 2016.
- [41] M. R. Raeisoon, S. Ghiasi Nadooshan, M. Eslahi, and Y. Mohammadi, "Comparing skills of critical thinking and happiness among students of faculty of medial sciences and other universities of Ghaen," *Future of Medical Education Journal*, vol. 7, no. 1, pp. 3–7, 2017.
- [42] J. Kuhpayehzadeh Isfahani, S. Jazayeri, N. Aryaeian, and H. Karami Aqhqhaleh, "The effect of team-based learning on critical thinking of nursing students at Iran University of Medical Sciences in 2014," *Journal of Medical Education and Development*, vol. 11, no. 3, pp. 186–200, 2017.
- [43] A. Shakurnia and M. Aslami, "Critical thinking skills of medical students at Ahvaz Jundishapur University of Medical Sciences," *Iranian Journal of Medical Education*, vol. 17, pp. 420–427, 2017.
- [44] F. Zarabian, B. Zandi, and S. M. Azizi, "Study of critical thinking disposition in virtual graduated students," *Research in Medical Education*, vol. 8, no. 1, pp. 37–46, 2016.
- [45] R. Askari, Z. Hatamizadeh, F. Sepase, and S. Rafiei, "Critical thinking skills among healthcare management college students: a case study in Iran: a study conducted in 2016," *Journal of Medical Education and Development*, vol. 13, no. 2, pp. 161–171, 2018.

- [46] L. Darban, S. Ashtari, Z. Forghani, and S. Yazdani, "Evaluation of critical thinking skills among medical sciences students in Shahid Beheshti and Tehran University of Medical Sciences," *Medical Sciences Journal*, vol. 26, no. 4, pp. 229–237, 2016.
- [47] S. Maleki and Z. Sanisales, "The relationship between ICT usage and critical thinking (case study, Shahrkoord University of Medical Sciences)," *Development Strategies in Medical Education*, vol. 3, no. 2, pp. 55–62, 2016.
- [48] S. Mousazadeh, M. Momennasab, T. Bakhtiari, and M. Reisi, "Nursing students' disposition toward critical thinking and its relationship with their academic performance," *Journal of Nursing Education*, vol. 5, no. 4, pp. 20–26, 2016.
- [49] Z. Shabouni, E. Nouhi, and M. Okhovati, "The effect of team-based learning in medical information systems course on academic achievement in postgraduate students of Kerman University of Medical Sciences, Iran," *Strides in Development of Medical Education*, vol. 13, no. 1, pp. 75–83, 2016.
- [50] Z. Moslemi, M. Ghomi, and D. Mohammadi, "The relationship between critical thinking skills with mental health and academic achievement of Qom University of Medical Sciences students," *Journal of Medical Education Development*, vol. 9, no. 23, pp. 90–101, 2016.
- [51] S. Gholamrezai, L. Yousefvand, and P. Radmehr, "The predictive role of self-efficacy and meta-cognitive on students tendency to critical thinking," *Research in Medical Education*, vol. 9, no. 1, pp. 45–37, 2017.
- [52] M. Hasanpour, Z. Izadian, M. Izadian, and F. Gholami Motlagh, "Relationship between nurses' conflict management styles and critical thinking skills in the clinical setting," *Iranian Journal of Nursing Research*, vol. 10, no. 4, pp. 58–66, 2016.
- [53] D. Mohammadi, Z. Moslemi, and M. Ghomi, "The relationship between critical thinking skills with creativity and academic achievement in students Qom University of Medical Sciences," *Bimonthly of Education Strategies in Medical Sciences*, vol. 9, no. 1, pp. 79–89, 2016.
- [54] Z. Azami and H. Salehiniya, "The relationship between critical thinking and information literacy among students of the school of management and medical information sciences of Tehran University of Medical Sciences, Iran," *Strides in Development of Medical Education*, vol. 12, no. 5, pp. 725–733, 2016.
- [55] S. M. Azizi, H. Zare, and H. Almasi, "The correlation of critical thinking disposition and achievement goal orientation with student entrepreneurial characteristics," *Iranian Journal of Medical Education*, vol. 16, pp. 200–209, 2016.
- [56] M. Gholami, P. K. Moghadam, F. Mohammadipoor et al., "Comparing the effects of problem-based learning and the traditional lecture method on critical thinking skills and metacognitive awareness in nursing students in a critical care nursing course," *Nurse Education Today*, vol. 45, pp. 16–21, 2016.
- [57] S. Dehghanzadeh and F. Jafaraghae, "Comparing the effects of traditional lecture and flipped classroom on nursing students' critical thinking disposition: a quasi-experimental study," *Nurse Education Today*, vol. 71, pp. 151–156, 2018.
- [58] A. Ajam, "The role of self-directed learning readiness and critical thinking disposition in students' interaction in blended learning environment," *Iranian Journal of Medical Education*, vol. 15, pp. 215–226, 2015.
- [59] L. Salehi, L. Keykavousi Arani, and M. Safarnavadeh, "Comparison between "problem-based learning" and "question & answer" educational methods on environmental health students' attitude to critical thinking," *Bimonthly of Education Strategies in Medical Sciences*, vol. 8, no. 1, pp. 35–42, 2015.
- [60] I. Azizi-Fini, A. Hajibagheri, and M. Adib-Hajbaghery, "Critical thinking skills in nursing students: a comparison between freshmen and senior students," *Nursing and Midwifery Studies*, vol. 4, no. 1, 2015.
- [61] F. Tanhaye Reshvanlou, M. Tanhaye Reshvanlou, and E. Hejazi, "Role of professor's teaching quality on the trend of health students to critical thinking," *Bimonthly of Education Strategies in Medical Sciences*, vol. 7, no. 6, pp. 391–397, 2015.
- [62] M. Tafazzoli, F. R. Fakari, M. Ramazanzadeh, and A. Sarli, "The relationship between critical thinking dispositions and academic achievement in Iranian midwifery students," *Nursing Practice Today*, vol. 7, no. 3, pp. 88–93, 2016.
- [63] M. Poodineh Moghadam, M. Jahantigh Haghghi, H. Shahdadi, S. Saravani, and F. Shojaei Shad, "The impact of evidence-based education on nursing students' critical thinking," *Journal of Nursing Education*, vol. 4, no. 2, pp. 9–17, 2015.
- [64] M. Hasanpour, A. Hasanzadeh, F. Ghaedi Heidari, and M. Bagheri, "Critical thinking skills of nursing students," *Iran Journal of Nursing*, vol. 28, no. 93, pp. 22–31, 2015.
- [65] B. Hajrezayi, H. Roshani Alibinasi, M. Shahalizade, M. Zeynali, and M. Badali, "Effectiveness of blended learning on critical thinking skills of nursing students," *Journal of Nursing Education*, vol. 4, no. 1, pp. 49–59, 2015.
- [66] S. Vahedi, M. M. Heydarlou, and A. Imanzadeh, "The relationship between emotional intelligence and critical thinking in nursing students of Tabriz University of Medical Sciences," *Development Strategies in Medical Education*, vol. 2, no. 1, pp. 47–57, 2015.
- [67] M. Rezaeian, M. Zare-Bidaki, M. Bakhtar, and K. Afsharmanesh, "Comparison of the critical thinking skills among medical students in different educational levels in Rafsanjan University of Medical Sciences in 2013," *Journal of Rafsanjan University of Medical Sciences*, vol. 13, no. 8, pp. 715–724, 2015.
- [68] S. Penjvini and M. S. Hejrani, "Critical thinking and clinical decision making skills in pediatric nursing students," *Research Journal of Pharmaceutical, Biological and Chemical Sciences*, vol. 6, no. 2, pp. 62–68, 2015.
- [69] F. Ghaedi and N. Toghiann, "Correlation between personality traits of critical thinking in nursing students of Isfahan University of Medical Sciences," *Development Strategies in Medical Education*, vol. 1, no. 1, p. 11, 2014.
- [70] H. Garavand, S. Sabzian, P. Kamkar, and S. Karami, "The role functions of thinking style in self-directed learning readiness and critical thinking disposition," *Biquarterly Journal of Cognitive Strategies in Learning*, vol. 2, no. 2, p. 19, 2015.
- [71] S. Shahjooi, S. Jalalmanesh, and E. Ebrahimi, "Relationship between critical thinking and interpersonal communication skills in nursing students of Azad University Tehran medical branch," *Journal of Nursing Education*, vol. 3, no. 3, pp. 1–13, 2014.
- [72] E. Noohi, S. Salahi, and S. Sabzevari, "Association of critical thinking with learning styles in nursing students of school of nursing and midwifery Iran," *Strides in Development of Medical Education*, vol. 11, no. 2, pp. 179–186, 2014.
- [73] T. Taghavi Larijani, M. Mardani Hmouleh, N. Rezaei, F. Ghadirriyan, and A. Rashidi, "Relationship between assertiveness and critical thinking in nursing students," *Journal of Nursing Education*, vol. 3, no. 1, pp. 32–40, 2014.

- [74] S. Yasayi, V. Navasarian, and A. Davari, "Critical thinking skills among dental students of Shahid Sadoughi University of Medical Sciences: a comparison in 2013," *Journal of Medical Education and Development*, vol. 9, no. 1, pp. 70–78, 2014.
- [75] M. Hemmati Maslak Pak, S. Orujlu, and H. Khalkhali, "The effect of problem-based learning training on nursing students' critical thinking skills," *The Journal of Medical Education and Development*, vol. 9, no. 1, pp. 24–33, 2014.
- [76] M. A. Hosseini, K. Karami, L. Abbasi, and H. Zahednezhad, "The effect of an active educational method on critical thinking of nursing students in Lorestan University of Medical Sciences," *Iranian Journal of Medical Education*, vol. 14, no. 5, pp. 403–410, 2014.
- [77] R. Rezaei, S. Saatsa, S. H. Sharif Nia, S. Molookzadeh, and Z. Beheshti, "Evaluation of nursing students, critical thinking skills in Mazandaran University of Medical Sciences," *Bi-annual Journal of Medical Education Education Development Center (Edc) Babol University of Medical Sciences*, vol. 2, no. 1, pp. 29–34, 2014.
- [78] T. Khazaei, M. Tolyat, T. Khazaei, and M. R. Hajiabadi, "Compared critical thinking in first year students and senior operating room and anesthesia Birjand University of Medical Sciences in 1390," *Development Strategies in Medical Education*, vol. 1, no. 2, pp. 37–43, 2014.
- [79] M. Najafianzadeh, M. Khorsandi, and A. Mobarak Abadi, "Critical thinking skills and their association with stress coping strategies in the students of Arak University of Medical Sciences Iran," *Strides in Development of Medical Education*, vol. 11, no. 3, pp. 387–393, 2014.
- [80] Z. Ghazivakili, R. N. Nia, F. Panahi, M. Karimi, H. Gholsorkhi, and Z. Ahmadi, "The role of critical thinking skills and learning styles of university students in their academic performance," *Journal of Advances in Medical Education & Professionalism*, vol. 2, no. 3, p. 95, 2014.
- [81] E. Ghadampour, N. Keshtiaray, H. Naserian Hajiabadi, A. Mohammadzadeh Ghasr, and H. Garavand, "Learning style priorities and its role in critical thinking disposition among nursing school students in Mashhad University of Medical Sciences," *Iranian Journal of Medical Education*, vol. 13, no. 8, pp. 652–662, 2013.
- [82] M. Karimi Noghondar, F. Rahnama Rahsepar, M. Golafrooz, and M. Mohsenpour, "Comparison of critical thinking and clinical decision making skills among the last-semester nursing students and practicing nurses in Sabzevar University of Medical Sciences," *Iranian Journal of Medical Education*, vol. 12, no. 12, pp. 916–924, 2013.
- [83] M. K. Meibodi, S. Lakdzaji, F. Abdollahzadeh, H. Hassankhanh, A. Rahmani, and K. Lasater, "Impact of guided reciprocal peer questioning on the disposition of critical thinking among nursing students," *Thrita Journal of Medical Sciences*, vol. 2, no. 3, pp. 10–14, 2013.
- [84] A. Sabouri Kashani, N. Faal Ostadzar, H. Karimi Moonaghi, and M. Gharib, "Critical thinking dispositions among medical students in two stages: basic medical sciences and pre-internship," *Iranian Journal of Medical Education*, vol. 12, no. 10, pp. 778–785, 2013.
- [85] F. Sheikhmoonesi, H. Barani, M. Khademloo, R. Sharifian, M. Jahani, and H. Lamsechi, "Critical thinking abilities among students of medicine in Mazandaran University of Medical Sciences, 2011," *Journal of Mazandaran University of Medical Sciences*, vol. 23, no. 98, pp. 98–103, 2013.
- [86] S. Tashi, F. Mortazavi, S. Yazdani, and Y. Mottaghipour, "Evaluating critical thinking skills in medical students Isfahan University of Medical Sciences Iran," *Strides in Development of Medical Education*, vol. 9, no. 2, pp. 170–178, 2013.
- [87] P. Abasi, V. Sepahi, A. Khoshay, S. Iranfar, and M. Timareh, "Critical thinking disposition and its relationship with self-esteem in pre-clinical and clinical medical students of Kermanshah University of medical sciences," *Iranian Journal of Medical Education*, vol. 13, no. 6, pp. 498–508, 2013.
- [88] F. Kermansaravi, A. Navidian, and A. Kaykhaei, "Critical thinking dispositions among junior, senior and graduate nursing students in Iran," *Procedia—Social and Behavioral Sciences*, vol. 83, pp. 574–579, 2013.
- [89] K. Gupta, S. Iranfar, K. Iranfar, B. Mehraban, and N. Montazeri, "Validly and reliability of California critical thinking disposition inventory (CCTDI) in Kermanshah University of Medical Sciences," *Educational Research in Medical Sciences*, vol. 1, no. 1, pp. 6–10, 2012.
- [90] N. Hariri and Z. Bagherinejad, "Analysis of the relationship between motivation and critical thinking with intentional internet search behavior case study: students of Mazandaran University of Medical Sciences, hygiene faculty," *Iranian Journal of Information Processing Management*, vol. 27, no. 4, pp. 801–822, 2012.
- [91] H. A. Nasrabadi and S. Mousavi, "The contribution of critical thinking attitude and cognitive learning styles in predicting academic achievement of medical university's students," *Iranian Journal of Medical Education*, vol. 12, no. 4, pp. 285–296, 2012.
- [92] S. S. Mahmoodabad, H. Nadrian, and H. Nahangi, "Critical thinking ability and its associated factors among preclinical students in Yazd Shaheed Sadoughi University of Medical Sciences (Iran)," *Medical Journal of the Islamic Republic of Iran*, vol. 26, no. 2, p. 50, 2012.
- [93] K. Iranfar, S. Iranfar, and G. Mohammadi, "Developing critical thinking disposition in the students of nursing and midwifery through collaborative and individual methods of learning," *HealthMED*, vol. 6, no. 12, pp. 4047–4052, 2012.
- [94] Y. Safari, Y. Pasdar, and M. Darbandi, "The comparison between critical thinking disposition of teachers and students in Kermanshah University of Medical Sciences, 2011," *Journal of Kermanshah University of Medical Sciences*, vol. 16, no. 2, pp. 148–154, 2012.
- [95] E. Paryad, N. Javadi, K. Fadakar, and S. Asiri, "Relationship between critical thinking and clinical decision making in nursing students," *Iran Journal of Nursing*, vol. 24, no. 73, pp. 63–71, 2011.
- [96] K. Khodamoradi, M. Seyed Zakerin, M. Shahabi, F. Yaghmaie, and H. Alavi Majd, "Comparing critical thinking skills of first-and last-term baccalaureate students of nursing, midwifery and occupational therapy of medical universities of Tehran city," *Medical Science Journal of Islamic Azad University—Tehran Medical Branch*, vol. 21, no. 2, pp. 134–140, 2011.
- [97] H. Kareshki and H. Pakmehr, "The relationship between self-efficacy beliefs, meta-cognitive and critical thinking with mental health in medical sciences students," *Hakim Research Journal*, vol. 14, pp. 180–187, 2011.
- [98] F. Haghani, B. Aminian, F. Kamali, and S. Jamshidian, "Critical thinking skills and their relationship with emotional intelligence in medical students of introductory clinical medicine (ICM) course in isfahan university of medical sciences," *Iranian Journal of Medical Education*, vol. 10, no. 5, 2011.

- [99] M. Kiany, M. Afshinjo, M. Pormemary, and K. Amini, "Comparison of critical thinking skills and dispositions between the nursing students and clinical nurses of selected educational hospitals of Zanjan University of Medical Sciences," *Journal of Advances in Medical and Biomedical Research*, vol. 20, no. 78, pp. 113–122, 2012.
- [100] M. Barkhordary, S. Jalalmanesh, and M. Mahmoudi, "Critical thinking Dispositions in baccalaureate nursing students of Shahid Sadooghi and Azad University of Medical Sciences in Yazd city," *Iran Journal of Nursing*, vol. 24, no. 69, pp. 18–25, 2011.
- [101] R. Eslami Akbar and F. Maarefi, "A comparison of the critical thinking ability in the first and last term baccalaureate students of nursing and clinical nurses of Jahrom University of Medical Sciences in 1386," *Pars of Jahrom University of Medical Sciences*, vol. 8, no. 1, pp. 38–45, 2010.
- [102] Z. Dehghani, M. Moattari, A. Abaszadeh, and M. Bahreini, "The effect of reflection on clinical journalism on critical thinking skills of nursing students in shiraz medical university," *Interdisciplinary Journal of Virtual Learning in Medical Sciences*, vol. 1, no. 2, pp. 17–23, 2020.
- [103] Z. Athari, M. Sharif, M. Nematbakhsh, and H. Babamohammadi, "Evaluation of critical thinking skills in Isfahan University of Medical Sciences' students and its relationship with their rank in university entrance exam rank," *Iranian Journal of Medical Education*, vol. 9, no. 1, pp. 5–12, 2009.
- [104] M. Gharib, M. Rabieian, M. Salsali, E. Hadjizadeh, A. S. Kashani, and H. Khalkhali, "Critical thinking skills and critical thinking dispositions in freshmen and senior students of health care management," *Iranian Journal of Medical Education*, vol. 9, no. 2, 2009.
- [105] Z. Karimi, Z. Molazem, J. Malekzadeh, and H. Khalili, "The critical thinking skills levels of students enrolled in a four years bachelor program at nursing college in Yasouj," *Research in Medical Education*, vol. 1, no. 1, pp. 1–6, 2007.
- [106] H. Baba Mohammadi and H. Khalili, "Critical thinking skills of nursing students in Semnan University of Medical Sciences," *Iranian Journal of Medical Education*, vol. 4, no. 2, pp. 23–31, 2004.
- [107] T. Mirmolaei, H. Shabani, G. Babaei, and Z. Abdehagh, "Comparison of critical thinking among first and last trimester baccalaureate midwifery students," *Hayat*, vol. 10, no. 3, pp. 69–77, 2004.
- [108] R. M. Cisneros, "Assessment of critical thinking in pharmacy students," *American Journal of Pharmaceutical Education*, vol. 73, no. 4, p. 66, 2009.
- [109] J. Wessel and R. Williams, "Critical thinking and learning styles of students in a problem-based, master's entry-level physical therapy program," *Physiotherapy Theory and Practice*, vol. 20, no. 2, pp. 79–89, 2004.
- [110] S. Hunter, V. Pitt, N. Croce, and J. Roche, "Critical thinking skills of undergraduate nursing students: description and demographic predictors," *Nurse Education Today*, vol. 34, no. 5, pp. 809–814, 2014.
- [111] S. Sahoo and C. A. Mohammed, "Fostering critical thinking and collaborative learning skills among medical students through a research protocol writing activity in the curriculum," *Korean Journal of Medical Education*, vol. 30, no. 2, p. 109, 2018.
- [112] C. Troussas, A. Krouska, M. Virvou, and E. Sougela, "Using hierarchical modeling of thinking skills to lead students to higher order cognition and enhance social e-learning," in *Proceedings of the 2018 9th International Conference on Information, Intelligence, Systems and Applications (IISA)*, Zakynthos, Greece, 2018.
- [113] A. Krouska, C. Troussas, and M. Virvou, "Computerized adaptive assessment using accumulative learning activities based on revised bloom's taxonomy," in *Proceedings of the 2018 Joint Conference on Knowledge-Based Software Engineering*, Corfu, Greece, 2018.
- [114] N. Kowalczyk, "Review of teaching methods and critical thinking skills," *Radiologic Technology*, vol. 83, no. 2, pp. 120–132, 2011.
- [115] S. E. Walker, "Active learning strategies to promote critical thinking," *Journal of Athletic Training*, vol. 38, no. 3, p. 263, 2003.
- [116] J. Maghsoudi, S. Etemadifar, and F. Haghani, "Improving critical thinking of students: a great challenge in clinical nursing education," *Iranian Journal of Medical Education*, vol. 10, no. 5, 2011.
- [117] T. Noone and A. Seery, "Critical thinking dispositions in undergraduate nursing students: a case study approach," *Nurse Education Today*, vol. 68, pp. 203–207, 2018.
- [118] D. Pu, J. Ni, D. Song et al., "Influence of critical thinking disposition on the learning efficiency of problem-based learning in undergraduate medical students," *BMC Medical Education*, vol. 19, no. 1, p. 1, 2019.
- [119] L. Huang, Z. Wang, Y. Yao et al., "Exploring the association between parental rearing styles and medical students' critical thinking disposition in China," *BMC Medical Education*, vol. 15, no. 1, p. 88, 2015.
- [120] P. A. Facione, "The disposition toward critical thinking: its character, measurement, and relationship to critical thinking skill," *Informal Logic*, vol. 20, no. 1, 2000.