Journal of Research in Clinical Medicine

*J Res Clin Med*. 2025;13:34565
doi: 10.34172/jrcm.025.34565
https://jrcm.tbzmed.ac.ir

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Review Article

# Unlocking the power of critical thinking: a systematic review on Iranian nursing students

**Mohammadamin Jandaghian-Bidgoli[1], Shedia Jamalnia[2,3], Marzieh Pashmforosh[4], Negin Shaterian[5], Pouriya Darabiyan[6], Alireza Rafi[4,7*]**

[1]Nursing Department, Faculty of Medical Sciences, Tarbiat Modares University, Tehran, Iran
[2]Department of Nursing and Midwifery, Kaz.C., Islamic Azad University, Kazerun, Iran
[3]Student Research Committee, Department of E-Learning in Medical Sciences, Virtual School, Center of Excellence in E-Learning, Shiraz University of Medical Sciences, Shiraz, Iran
[4]Behbahan Faculty of Medical Sciences, Behbahan, Iran
[5]Student Research Committee, Kashan University of Medical Sciences, Kashan, Iran
[6]Student Research Committee, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran
[7]Department of Nursing and Midwifery, Be.C., Islamic Azad University, Behbahan, Iran

**Article info**

**Article History:**
**Received:** August 29, 2023
**Revised:** June 21, 2024
**Accepted:** June 23, 2024
**ePublished:** September 28, 2025

**Keywords:**
Critical, Nurse, Students, Thinking

**Abstract**

**Introduction:** Recent concerns have surfaced regarding the insufficient development of critical thinking skills among nursing students, resulting in a gap between theoretical knowledge and practical application. This study aimed to address this gap and explore the significance and methods of developing critical thinking among Iranian nursing students.

**Methods:** This study followed the PRISMA guidelines to conduct a systematic literature review, using a rigorous method that included document organization, data extraction, quality assessment, and report writing. The search included all observational or interventional studies, with full-text availability in Persian or English languages. Non-original publications were excluded. PubMed, SID, Magiran, and Scopus databases were searched, and the study selection process involved evaluating titles, abstracts, and full texts. Data extraction included analyzing the characteristics of the included studies, while methodological quality assessment employed suitable tools.

**Results:** Out of 1314 initially identified articles, a total of 22 high-quality studies were reviewed in this systematic review. These studies, conducted between 2016 to 2022, examined critical thinking in Iranian nursing students. The interventions evaluated various approaches including problem-based learning, conceptual mapping, flipped classroom, clinical reasoning, and team-based learning, while the observational studies explored the association between critical thinking and emotional intelligence, learning styles, and academic performance factors.

**Conclusion:** This study underscores the significance of developing critical thinking skills among Iranian nursing students and suggests the effectiveness of utilizing problem-based learning and conceptual mapping strategies in enhancing critical thinking abilities.

## Introduction

Health professionals are supposed to manage health, educational, economic, and social challenges in their professional society. Clinical judgment of nurses is extremely important to meet the needs of their patients.[1] Similarly, one of the important goals of nursing education is to train nurses for providing decent services to the society using their knowledge and skills.[2] Critical thinking is a type of purposeful and self-regulating judgment forming through clinical reasoning and solving patient's problems.[3] In other words, critical thinking is the cognitive process of using purposeful and insightful judgment, including the development and effective application of multiple dimensions of cognition for interpreting and analyzing a situation and achieving a solution.[4] The development of intellectual skills of students is a complex issue in education that is in a critical state. In recent years, education experts have expressed concern about students' inability to think critically.[5] Based on previous reports, when encountering the problems of patients in critical situations, nurses cannot make appropriate decisions and, in most cases, they merely follow physicians' orders. So, this leads to a decrease in the quality of the services provided.[6] Because the traditional education methods did not focus on training the individuals for solving future professional problems in their professional society, critical thinking should be considered a priority in the learning process of students. The existing gap between theory and practice in the areas related to human health is significant. Despite passing many theory units, students are not

***Corresponding Author:** Alireza Rafi, Email: alirezarafi72@gmail.com

able to apply their knowledge in clinical situations.[7] In 1986, The American Association of Colleges of Nursing (AACN) announced the growth and development of critical thinking skills as an essential component for the evaluation of undergraduate and graduate students. Additionally, AACN introduced critical thinking as a mandatory part of nurse credentialing.[8]

Nurses play an important role in forming the desired outcomes of all the health care systems around the world.[9] The swift alterations in health care systems require flexible, personalized, and decisive reactions by nurses.[10] The decision taken by the nurse often involves complex problems related to the physical, mental, and social health conditions of patients and even includes interaction with other systems. The nurses must be able to make complex decisions based on critical thinking via gathering various information and interpreting them in their minds.[11] Hence, there should be an appropriate educational program based on critical thinking for nursing students on how to manage tough situations and dilemmas.[12] Even, critical thinking is associated with nursing students' academic achievement.[13] There are various ways to develop critical thinking including team-based learning, concept mapping, case studies, and problem-based learning.[14] According to evidence, even Florence Nightingale emphasized critical thinking-based teaching methods. Considering the high density of hospital tasks and the acceptance of responsibility for patient care measures by nurses, it is not surprising that patient satisfaction with nursing care is a key indicator of overall hospital satisfaction.[15] Notably, the active involvement of nursing students is of great importance and the instructors are the facilitators of critical thinking among the students.[16]

Normally, nurses execute critical thinking based on two naib factors: cognition and skills. Additionally, the nursing process including discovering information, questioning, analysis, and evaluation can be addressed for teaching critical thinking to nursing students.[17] Nursing experts created the Nursing Consensus Statement (NCS) to explain the critical thinking in nurses.[16] The NCS consists of 17 items: 10 habits of mind and 7 cognitive skills. The habits of mind comprise perseverance, open-mindedness, flexibility, confidence, creativity, inquisitiveness, reflection, intellectual integrity, intuition, and contextual perspective. On the other hand, cognitive skills consist of information seeking, discriminating, analyzing, transforming knowledge, predicting, applying standards, and logical reasoning.

Although a systematic review has been conducted regarding critical thinking in Iranian nursing students,[17] this study aimed to fill the gap concerning critical thinking in Iranian nursing students. Additionally, the methods of developing critical thinking in Iranian nursing students were investigated.

## Methods

The study was conducted based on Preferred Reporting Items for Systematic Reviews and Meta-Analyzes (PRISMA) guidelines.[18] The systematic review process included the documents organization, data extraction, quality assessment, and writing reports were executed, respectively.

### *Inclusion criteria*

The inclusion criteria for this study were as follows:

1. The study should have been conducted on Iranian nursing students
2. The study has to be observational or interventional.
3. The study should have given information about the various aspects of critical thinking in Iranian nursing students.
4. The full text should have been available in Persian or English languages.

The excluded studies were non-original publications such as reviews, letters to the editor, or abstracts only.

Based on PICO framework, P (Iranian nursing students), I (interventions such as concept mapping, flipped classroom, problem-based), C (traditional learning methods), and O (improvement in critical thinking).

### *Searching in the databases*

The PubMed, SID, Magiran, and Scopus databases were independently searched by two authors from the beginning of 2016 until the end of 2022. The titles and abstracts of the articles were searched using various databases using a combination of the following keywords with search operators (AND, OR): (“Critical thinking*” [tiab] OR “Thinking Skills” [tiab] OR “Thinking Skill” [tiab] OR “Kolb Thought”[tiab] OR “Critical Thinking”[tiab] OR “Thoughts”[tiab]) AND ("medical education"[tiab] OR "medical education"[tiab] OR "nursing education"[tiab] OR "nursing student"[tiab])

### *Study delection*

Initially, the titles and abstracts of included studies were evaluated to determine whether they were eligible. Two authors independently assessed the full text. In terms of any disagreement, the third author resolved it. Additionally, a table was designed to compare the studies based on inclusion criteria.

### *Data extraction*

Two reviewers extracted and descriptively analyzed the characteristics of included studies. First author's name, publication year, sample size, gender, study type, course, measurement tool, analysis method, type of education and main findings.

### *Assessment of methodological quality*

The STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) statement was used for the quality assessment of included observational studies. Basically, it has 22 items used for the assessment.[19]

The Joanna Briggs Institute Meta-Analysis of Statistics Assessment and Review Instrument (JBI-MAStARI) was used for the assessment of nonrandomized interventional and randomized interventional studies.[20] Two authors were responsible for the methodological quality of the included studies. The third author resolved any disagreement between the reviewers.

## Results

The search strategy resulted in the retrieval of a total of 1314 articles, of which 22 studies were included in the study. At first, 682 duplicate articles were excluded. Then, 437 articles were removed owing to the lack of relevance. Subsequently, 195 records went through full-text evaluation. Ultimately, 22 high-quality studies on critical thinking in Iranian nursing students (2016 to 2022) were included. Additionally, Figure 1 shows the process of article selection based on the PRISMA protocol. The total sample size was 1838. Three randomised controlled trials, eleven quasi-experimental clinical trials, seven descriptive-correlational studies, and one cross-sectional study made up the total of 22 included papers. Eight observational studies were analysed using the STROBE checklist, as indicated in Table 1, and fourteen interventional or quasi-experimental studies were compiled using the JBI-MAStARI tool, as indicated in Table 2; All 22 included studies are summarised in Table 3.Twenty studies were only conducted on undergraduates. Two studies included both undergraduates and graduate nursing students.

The retrieved interventional studies mainly focused on evaluating the effect of problem-based learning,[21-24] conceptual mapping,[23,25-29] flipped classroom,[30,31] clinical reasoning,[32] portfolio and direct observation of procedural skills model,[33] and team-based learning on critical thinking. Meanwhile, the retrieved observational studies assessed the association of emotional intelligence,[34,35] creative education atmosphere,[36] professional self-concept,[37] learning style and academic achievement,[38] self-efficacy,[39] self-regulation strategies,[40] and academic performance[41] with critical thinking in Iranian nursing students. Overall, the results indicated that various types of interventions are effective in improving the level of critical thinking. Therefore, there were promising findings regarding the interventions aimed at improving the critical thinking of Iranian nursing students. Only one study reported that critical thinking scores increased both in the intervention and the control group receiving routine procedures. However, there was an association between critical thinking and demographic variables. For instance, females and single students had lower scores in critical thinking.[37] Additionally, the nursing students who participated in conceptual mapping courses, had a higher ability to conduct nursing care plans.[25] One study compared the efficacy of problem-based learning and conceptual mapping. Eventually, problem-based learning was more effective in improving the critical thinking level.[24] As well, there was no significant association between critical thinking and the type of learning styles.[38] Regarding the association of critical thinking with emotional intelligence, the results were inconsistent, as one study claimed a significant association between critical thinking and emotional intelligence.[34] However, another study showed that there is no significant correlation between these two components.[35]

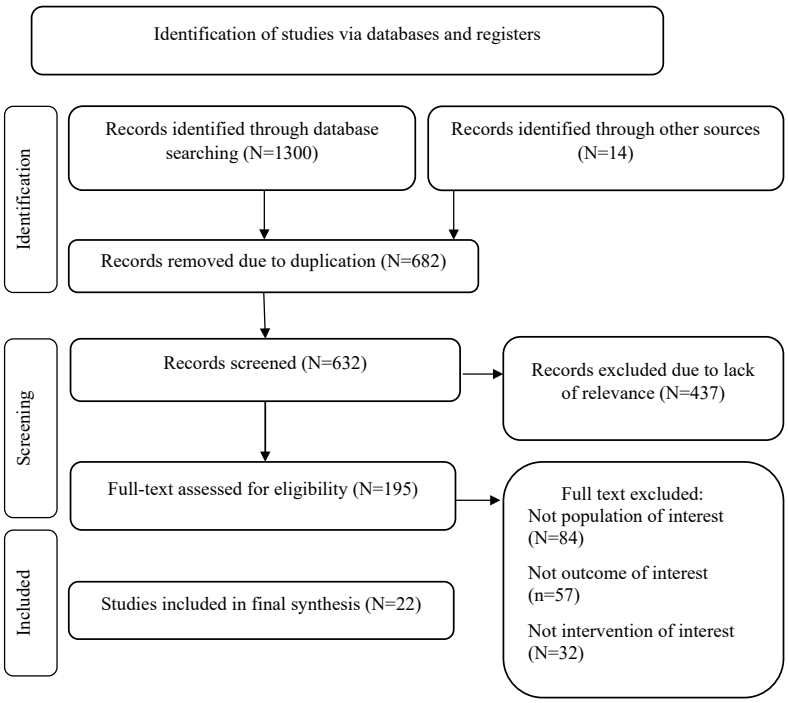


**Figure 1.** PRISMA Flowchart of selected studies

### *Quality assessment*

Table 1 presents an overview of the quality assessment of studies based on the STROBE statement, while Table 2 summarizes the quality assessment results of quasi-experimental and experimental studies.

An overview of the included studies is presented in Table 3.

## Discussion

This systematic review aimed to evaluate intervention and factors associated with Iranian nursing students. Most of the retrieved interventional studies demonstrated that specific plans or programs, including problem-based learning and concept mapping, could enhance students' critical thinking; however, a few studies reported non-significant or mixed findings, such as improvements observed in both intervention and control groups. Besides, the observational studies showed the association of various components with critical thinking. Also, some research have demonstrated the importance of teamwork and collaborative learning in raising critical thinking proficiency.[42] In line with the results of this study about effect of problem-based learning on increasing the total score of critical thinking, a study in Saudi Arabia showed that problem-based learning can develop critical thinking in nursing students.[43] Similarly, another study revealed that problem-based learning can improve critical thinking through forming discussions, supportive atmosphere, encouraging to discover interest and building trust.[44] Consistent with the results of this systematic review regarding the effect of conceptual mapping on improving critical thinking, a study in Turkey proved that using conceptual mapping can lead to an increase in the total score of critical thinking.[45] Similarly, a study in the United States revealed that students in the conceptual mapping group achieved higher scores in critical thinking.[46] Even, some students were not satisfied with conceptual mapping due to its heavy workload, but it ultimately led to an improvement in their level of critical thinking.[47] However,

**Table 1.** The STROBE statement scores

| Author and year of publication | Q1 | Q2 | Q3 | Q4 | Q5 | RB |
|---|---|---|---|---|---|---|
| Lotfi et al[36] (2020) | + | + | ? | + | ? | + |
| Barry et al[37] (2020) | + | + | ? | ? | + | ? |
| Bagheri et al[34] (2019) | + | ? | ? | ? | + | ? |
| Shirazi and Heidari[38] (2019) | ? | + | ? | + | + | + |
| Hasanpour et al[35] (2018) | + | + | ? | ? | - | - |
| Orujlu and Hemmati Maslakpak[39] (2017) | + | ? | + | + | ? | ? |
| Rasooli et al[40] (2016) | ? | ? | + | + | - | - |
| Mousazadeh et al[41] (2016) | ? | + | + | ? | + | + |

Low risk: +
Moderate risk: ?
High risk: -
Q1: Methods for selecting study participants; Q2: Methods for measuring exposure and outcome variables; Q3: Methods to control confounding; Q4: design-specific sources of bias; Q5: statistical methods; RB: Risk of bias.

**Table 2.** Critical appraisal checklist summary for randomized control/pseudo-randomized trials (JBI-MAStARI)

| Author and year of publication | Q1 | Q2 | Q3 | Q4 | Q5 | Q6 | Q7 | Q8 | Q9 | RB |
|---|---|---|---|---|---|---|---|---|---|---|
| Dehghanzadeh and Moaddab[25] (2021) | + | + | + | + | + | + | ? | + | + | + |
| Momeni et al[33] (2021) | + | + | + | + | + | + | ? | + | + | + |
| Aein et al[21] (2020) | + | - | + | + | ? | - | ? | ? | + | ? |
| Ahmady and Shahbazi[22] (2020) | + | - | + | ? | ? | ? | + | + | + | ? |
| Roshangar et al[27] (2020) | + | + | + | + | + | + | ? | ? | - | - |
| Mohammadi et al[26] (2019) | + | - | ? | + | + | + | + | ? | + | ? |
| Kameli et al[32] (2019) | + | + | + | ? | ? | ? | + | + | + | + |
| Dehghanzadeh et al[31] (2018) | + | + | ? | + | + | ? | + | + | ? | + |
| Dehghanzadeh and Jafaraghaie[30] (2018) | + | + | + | + | + | ? | + | + | + | + |
| Momeni et al[24] (2017) | + | + | ? | + | + | + | + | ? | ? | + |
| Sadeghi-Gandomani et al[28] (2017) | + | + | ? | ? | + | ? | + | + | + | + |
| Sadeghi et al[29] (2016) | + | ? | ? | + | + | + | + | ? | + | ? |
| Gholami et al[23] (2016) | + | ? | + | + | + | ? | + | ? | + | ? |
| Kuhpayehzadeh et al[42] (2016) | + | - | + | + | + | ? | ? | + | + | + |

Low risk: +
Moderate risk: ?
High risk: -
Q1: Was the study based on a random or pseudorandom sample?
Q2: Were the criteria for inclusion in the sample clearly defined?
Q3: Were confounding factors identified and strategies to deal with them stated?
Q4: Were the outcomes assessed using objective criteria?
Q5: If comparisons are being made, was there sufficient description of the groups?
Q6: Was the follow-up carried out over a sufficient time period?
Q7: Were the outcomes of people who withdrew described and included in the analysis?
Q8: Were the outcomes measured in a reliable way?
Q9: was an approximate statistical analysis used?
RB: Risk of bias

**Table 3.** Overview of Included Studies

| Study ID | Study Type | Sample Size (F/M) | Course | Measurement Tools | Analysis method | Type of education | Key findings/Main points |
|---|---|---|---|---|---|---|---|
| Dehghanzadeh and Moaddab[25] (2021) | RCT | 83 (70/13) | BSN | The CCTST and a concept map scoring scale | Chi- square, independent and paired t- test | Concept mapping | - significantly higher scores of critical thinking in the intervention group in the areas of analysis ($P=0.046$) and deductive reasoning ($P=0.025$) compared with the controls<br>- Higher score of nursing process in the intervention group ($P<0.001$) |
| Momeni et al[33] (2021) | RCT | 32 (20/12) | BSN | CCTDI | Independent t- test | Portfolio and direct observation of procedural skills model | - Higher tendency to critical thinking in the portfolio group ($P\leq0.001$) |
| Aein et al[21] (2020) | CT | 48 (48/0) | BSN | CCTST | Paired t-test | Problem-based | - Significant improvement of critical thinking after intervention ($P<0.05$)<br>- Evaluation and inductive reasoning domains did not improve significantly<br>- High level of satisfaction with learning experience in the students |
| Lotfi et al[36] (2020) | Descriptive and correlational | 164 (100/64) | BSN | Creative atmosphere scale and critical thinking scale | Independent t-test, analysis of variance, regression coefficient and Pearson correlation coefficient | NA | - Significant positive relationship between educational atmosphere components of creative educational atmosphere with critical thinking ($P=0.000$)<br>- No statistically significant difference between male and female students with regard to critical thinking<br>- Predictive role of creative educational atmosphere components for critical thinking in students |
| Barry et al. [37] (2020) | Descriptive correlational | 154 (100/54) | BSN | Ricketts' Critical Thinking Disposition Assessment Scale and NSCQ | Pearson's correlation coefficient | NA | - A significant, inverse, moderate correlation between critical thinking and professional self-concept ($P<0.001$)<br>- The significant effect of sex ($P=0.003$), marital status ($P=0.05$) and ethnicity ($P=0.003$) on critical thinking |
| Ahmady and Shahbazi[22] (2020) | CT | 40 (24/16) | BSN | CCTST | Independent sampled T-test, paired T-test, square chi, and Pearson correlation coefficient | Problem-solving | - Positive effect of the intervention on critical thinking and decision-making ($P<0.05$)<br>- No significant alteration in the control group ($P>0.05$) |
| Roshangar et al[27] (2020) | CT | 55 (NR) | BSN | CCTST and CASES | Paired t-test | Conceptual mapping | - Improvement of the level of critical thinking after the intervention ($P=0.001$)<br>- Significant increase in critical thinking in the control group after intervention ($P<0.001$) |
| Mohammadi et al[26] (2019) | CT and case-control | 81 (65/16) | BSN | CCTDI | Paired t-test and independent t-test | Conceptual mapping | - significantly higher score of critical thinking in the intervention after intervention ($P<0.0001$)<br>- Significantly different post-intervention mean scores of two groups ($P<0.05$), except for inductive and inference areas ($P>0.05$) |
| Kameli et al. [32] (2019) | CT | 27 (0/27) | BSN | CCTST | Paired t-test | Clinical Reasoning | - Improvement of the score of critical thinking after the intervention ($P=0.047$) |
| Bagheri et al[34] (2019) | Descriptive correlation | 100 (77/23) | BSN | CCTST and The EQ-i 2.0 | Spearman correlation, Pearson correlation, T test and regression model | NA | - Positive correlation between total critical thinking score and total emotional intelligence score ($P<0.05$) |
| Shirazi and Heidari[38] (2019) | Cross-sectional | 139 (139/0) | BSN | CCTST, Kolb's Learning Style Standard Questionnaire | Student t test, one-way analysis of variance, chi-square, and correlation test | NA | - Evaluation and analysis subscales as the highest and lowest frequently used, respectively<br>- No statistically significant relationship between learning style and critical thinking ($P=0.74$) |

**Table 3.** Continued.

| Study ID | Study Type | Sample Size (F/M) | Course | Measurement Tools | Analysis method | Type of education | Key findings/Main points |
|---|---|---|---|---|---|---|---|
| Dehghanzadeh et al[30] (2018) | CT | 43 (35/8) | BSN | Ricketts' Critical Thinking Disposition Questionnaire | One-sample t-test, paired t-test, Pearson correlation coefficient and ANOVA | Flipped classroom | - Significant improvement of critical thinking disposition and the domain of intellectual engagement ($P=0.0001$) |
| Hasanpour et al[35] (2018) | Descriptive correlative | 169 (109/61) | BSN, MSc, Ph.D | CCTST, Emotional Intelligence Questionnaire | Pearson correlation coefficient, | NA | - No significant correlation between the total score of critical thinking skills and emotional intelligence ($P=0.62$), except for empathy ($P=0.001$) |
| Dehghanzadeh and Jafaraghaie[31] (2018) | CT | 81 (68/13) | BSN | Ricketts' Critical Thinking Disposition Inventory, | Paired-sample t, independent-sample t, and chi-square tests | Flipped classroom | - Higher mean score of critical thinking in the intervention group ($P<0.0001$) |
| Momeni et al[24] (2017) | RCT | 32 (22/10) | BSN | CCTDI | Independent and paired T-test | Concept mapping and problem-based | - The increase of the total score of critical thinking in both groups ($P=0.001$)<br>- higher improvement of critical thinking situation in problem-based learning group in sub-categories including open mindedness, self-confidence, inquisitiveness and maturity |
| Sadeghi-Gandomani et al. [28] (2017) | CT | 70 (39/31) | BSN | CCTDI | Independent and paired T-test and chi-squared test | Concept mapping | - Significant difference between the intervention and conventional group ($P=0.003$) after the intervention |
| Orujlu and Hemmati Maslakpak[39] (2017) | Correlational | 50 (31/19) | BSN | CCTDI and SGSES | Spearman and Pearson correlation coefficient tests | NA | - positive and significant correlation between critical thinking and self-efficacy of nursing students ($P=0.002$) |
| Sadeghi et al[29] (2016) | CT | 70 (39/31) | BSN | CCTDI | Independent and paired T-test and chi-squared test | Concept mapping | - Significant difference between the intervention and conventional group ($P=0.003$) after the intervention |
| Rasooli et al[40] (2016) | Descriptive and correlational | 160 (NR) | BSN and MSc | CCTDI, Information Literacy Questionnaire and SRQ-A | Pearson correlation test | NA | - Significant relationship between critical thinking and information literacy with self-regulation Strategies ($P<0.05$)<br>- significant relationship between sub-scale of evaluation, inference, inductive and deductive reasoning with self-regulation ($P<0.05$) |
| Gholami et al[23] (2016) | CT | 40 (25/15) | MSN | CCTST-B and MAI | Paired t-test | Problem-based | - Significant increase in the overall critical thinking score ($P<0.01$) and its sub-scales of evaluation and deduction ($P<0.05$) after intervention<br>- Improvement of metacognitive awareness after intervention ($P<0.001$)<br>- No significant alterations in the students' critical thinking skills and metacognitive awareness after executing the lecture method ($P=0.314$) |
| Kuhpayehzadeh et al[42] (2016) | CT | 80 (45/35) | MSN | Watson-Glaser critical thinking questionnaire | Independent T-test | Team-based | - Significant effect of team-based learning on critical thinking of the students ($P>0.05$)<br>- Improvement of understanding, identifying assumptions, inferences, interpretation, and evaluation of logical reasoning in the team-based learning group ($P<0.001$) |
| Mousazadeh et al[41] (2016) | Descriptive correlational | 120 (62/58) | MSN | Ricketts' Critical Thinking Disposition Questionnaire | Independent T-test, Pearson correlation test, ANOVA | NA | - Lack of significant correlation between the scores of students' disposition toward critical thinking and their total average grades ($P=0.85$)<br>- No significant association of age, gender, and years of academic study with critical thinking ($P>0.05$) |

CCTST, California Critical Thinking Skills Test; NSCQ, Nurses' Self-Concept Questionnaire ; CASES , College Academic Self-Efficacy Scale; CCTDI, The California Critical Thinking Dispositions Inventory; EQ-i 2.0, Bar-On Emotional Quotient Inventory; SGSES, Sherer's General Self-Efficacy Scale; SRQ-A, Academic Self-Regulation Questionnaire; MAI, Metacognitive Awareness Inventory; BSN, bachelor of science in nursing; MSN, master of science in nursing; CT, clinical trials; RCT, randomized controlled trial; NA, not applicable

this program can be implemented as a web-based course that can maintain its quality and increase the total score of critical thinking.[48] Conceptual mapping creates a network of relationships, allowing students to discover concepts and improve critical thinking through the design of various reasoning maps.[49] In other words, the nature of conceptual mapping encourages the learner to acquire more information and it is effective in enhancing the score of critical thinking.[50] In this way, the learner can classify new information and connect the old concepts with the new concept.[51] However, a study showed that conceptual mapping could not improve critical thinking.[52] Similarly, a study on nursing students proved that there was no significant difference between the scores of pre-test and post-test.[53] This finding can be related to a small sample size, high score of critical thinking before the intervention, Short intervention period, or group-based conceptual mapping. No study regarding simulation training has been conducted on Iranian nursing students in Iran since 2016. However, studies in other countries showed that simulation is in direct association with an improved level of critical thinking.[54] However, another study claimed that simulation can lead to a decreased level of critical thinking.[55] As well, simulation-based classes are directly associated with improvement in clinical judgment, self-efficacy, clinical abilities, and self-confidence.[56]

Without a doubt, enjoyable contexts encourage students to learn new things in a challenging and interactive manner.[57] Moreover, interesting educational programs can increase the tendency toward critical thinking, because they can reflect the real cases.[58] Problem-based learning or conceptual mapping enables the students to think deeply and organize their thinking.[57]

The findings of the current study showed that students in lower academic semesters had a lower level of critical thinking ability compared to students who were close to graduation.[34] This finding is in line with the results of previous studies.[59] However, some studies on nursing students showed no association between the semester and critical thinking.[2] The results regarding the association of emotional intelligence with critical thinking were contradictory. Similarly, previous research showed no significant association between these two components.[60] Additionally, other studies claimed that there was a correlation between emotional intelligence and critical thinking.[61] It is proved that integration of emotional intelligence into nursing education can lead to better professional performance. In this situation, the students will be able to handle the emotional conditions. As well, emotional intelligence is associated with better performance of students.[62] Seemingly, the development of critical thinking requires a long period to develop. Students who are spending the beginning and end of the academic year, possess a lower level of critical thinking disposition.[63] As well, most of the studies indicated that nursing students' critical thinking was moderate to low.[61-64] Even, a study on nurses showed that they had moderate critical thinking. Therefore, the intervention should be designed to enhance the students critical thinking. This study found an association between critical thinking and socio-demographic variables, which is in line with a study conducted in Spain.[65] On the contrary, a study in Turkey found no association between critical thinking and socio-demographics in nursing students.[66] Regarding the educational level, it was found that postgraduate students achieved higher critical thinking scores.[13] Additionally, some studies pointed out that clinical practice should offer a supportive environment that encourages critical thinking and questioning, and that stresses the use of multiple sources of knowledge, with special attention paid to the role of reflective writing as a pathway to enhance critical thinking, in order to utilize the competencies and skills of recently graduated nurses in evidence-based practice.[67,68]

## Limitations

Despite the efforts made by the authors, some undeniable limitations should be addressed. English and Persian articles were the only sources owing to the inclusion criteria. Also, dissertations, books, and grey literature were excluded in this systematic review. Additionally, only studies published from 2016 to 2022 were included. Few studies were methodologically inappropriate, but none of them were excluded.

## Conclusion

It is of great importance to use the methods to promote the critical thinking level in the nursing students. As well, the associated factors with critical thinking should not be neglected. There was a vast heterogeneity in the included studies that were related to critical thinking in Iranian nursing students. The intervention used in the included studies could significantly increase the total score of critical thinking.

This review highlights systematic review as an appropriate approach for nursing educators to assist undergraduate and post-graduate nursing students.

**Acknowledgements**

The study was also registered at Prospero (ID: CRD42023389637) (). The authors sincerely thank those who helped the authors with this research.

**Authors' Contribution**

**Conceptualization:** Mohammadamin Jandaghian-Bidgoli, Shedia Jamalnia, Marzieh Pashmforosh, Negin Shaterian, Pouriya Darabiyan, Alireza Rafi.

**Data curation:** Mohammadamin Jandaghian-Bidgoli, Marzieh Pashmforosh, Negin Shaterian, Shedia Jamalnia, Pouriya Darabiyan, Alireza Rafi.

**Formal analysis:** Mohammadamin Jandaghian-Bidgoli, Marzieh Pashmforosh, Negin Shaterian, Shedia Jamalnia, Pouriya Darabiyan, Alireza Rafi.

**Funding acquisition:** Mohammadamin Jandaghian-Bidgoli, Marzieh Pashmforosh, Negin Shaterian, Shedia Jamalnia, Pouriya Darabiyan, Alireza Rafi.
**Investigation:** Mohammadamin Jandaghian-Bidgoli, Marzieh Pashmforosh, Negin Shaterian, Shedia Jamalnia, Pouriya Darabiyan, Alireza Rafi.
**Methodology:** Mohammadamin Jandaghian-Bidgoli, Marzieh Pashmforosh, Negin Shaterian, Shedia Jamalnia, Pouriya Darabiyan, Alireza Rafi.
**Project administration:** Mohammadamin Jandaghian-Bidgoli, Negin Shaterian, Shedia Jamalnia, Pouriya Darabiyan, Alireza Rafi.
**Resources:** Mohammadamin Jandaghian-Bidgoli, Shedia Jamalnia, Pouriya Darabiyan, Alireza Rafi.
**Software:** Mohammadamin Jandaghian-Bidgol, Shedia Jamalnia, Alireza Rafi.
**Supervision:** Mohammadamin Jandaghian-Bidgoli, Marzieh Pashmforosh, Shedia Jamalnia, Alireza Rafi.
**Validation:** Mohammadamin Jandaghian-Bidgoli, Shedia Jamalnia, Pouriya Darabiyan, Alireza Rafi.
**Visualization:** Mohammadamin Jandaghian-Bidgoli, Shedia Jamalnia, Pouriya Darabiyan, Alireza Rafi.
**Writing–original draft:** Mohammadamin Jandaghian-Bidgoli, Marzieh Pashmforosh, Negin Shaterian, Shedia Jamalnia, Pouriya Darabiyan, Alireza Rafi.
**Writing–review & editing:** Mohammadamin Jandaghian-Bidgoli, Marzieh Pashmforosh, Negin Shaterian, Shedia Jamalnia, Pouriya Darabiyan, Alireza Rafi.

## Competing Interests

The authors state no conflicts of interest in this study.

## Ethical Approval

This study was approved by the Ethics Committee of Behbahan Faculty of Medical Sciences (Ethical Code:IR.BHN.REC.1402.036).

## Funding

This study was funded by Behbahan Faculty of Medical Sciences.

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