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Review Article

The Impact of Flipped Classroom Approach on Nursing Education in Iran: A Systematic Review

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ABSTRACT

Background: Instructional approaches such as the flipped classroom have been shown to improve nursing education by promoting student engagement and learning outcomes. This review aimed to examine the flipped classroom application in Iranian nursing programs, focusing on strategies, outcomes (such as knowledge acquisition, critical thinking skills, self-directed learning, satisfaction levels, motivation, and academic performance), challenges, facilitators, and virtual adaptations during COVID-19.

Methods: Following the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) guidelines, a systematic review assessed the flipped classroom's impact on Iranian nursing education. Databases searched included PubMed, Scopus, SID, Magiran, MEDLINE, and Google Scholar for studies from 2012 to 2022. Studies were included if they involved Iranian undergraduate or postgraduate nursing students, utilized the flipped classroom as the primary intervention or exposure, reported quantifiable outcomes, and were published in English or Persian. Exclusions encompassed research from non-nursing fields, studies without a flipped classroom component, systematic reviews, meta-analyses, letters to the editor, editorials, case reports, pilot studies, preliminary reports, or short communications. Two independent reviewers screened titles and abstracts, followed by full-text assessments; they then extracted data on study design, participant characteristics, intervention details, and results. Study quality was assessed using Kmet criteria, with scores ≥0.55 for inclusion.

Results: The systematic search identified 845 articles, of which 12 met the inclusion criteria for analysis. The included studies comprised 588 undergraduate nursing students, with sample sizes ranging from 34 to 102. Ten studies were quasi-experimental, one was descriptive, and one was qualitative. Flipped classroom sessions lasted 45–120 minutes and were sometimes adapted to participants' preferences. The studies reported diverse outcomes, including improvements in self-directed learning readiness, satisfaction, motivation, knowledge, critical thinking, learning approaches, and average course scores. Only two studies examined virtual flipped classrooms during the COVID-19 pandemic. Quality assessment indicated that all included studies met acceptable methodological standards.

Conclusion: Flipped classrooms boost nursing education aspects like self-directed learning and critical thinking, though inconsistencies and limited postgraduate research exist. Broader implementation could improve student preparation and patient care.

Keywords: Flipped Classroom, Nursing, Education, Curriculum, Teaching, Educational Outcomes, Self-Directed Learning

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Introduction

Nursing education plays a critical role in preparing individuals to maintain and enhance societal health (1). As such, nursing students must possess the ability to identify and address both potential and actual client issues, while also navigating complex and stressful situations (2). Furthermore, fostering personal and professional growth is essential for nursing learners (3). However, the landscape of medical knowledge is continuously evolving, mirroring the changing needs of patients (4). Consequently, there is an urgent call for a transformative shift in educational paradigms within medical disciplines, including nursing, to close the divide between theoretical knowledge and clinical application (5). Since nurses form a substantial part of the healthcare workforce, their training demands meticulous attention (6).

Traditionally, nursing education has relied on didactic lectures as the primary mode of knowledge dissemination, resulting in passive learning experiences for students and limited opportunities for deep engagement (7). This conventional approach often fails to cultivate the critical thinking and problem-solving abilities required for competent clinical practice (8). Moreover, the sheer volume of content coupled with constrained class time presents a formidable challenge for educators seeking to adequately prepare students for real-world healthcare scenarios (9). In response to these challenges, educators are increasingly turning to innovative teaching methodologies that promote active student involvement and facilitate deeper learning experiences. Among these approaches, the flipped classroom model has garnered considerable attention (10). Rooted in technology, the flipped classroom method flips the traditional teaching paradigm by shifting content delivery outside the classroom through pre-recorded lectures or readings, thus allowing in-class time to be dedicated to interactive, application-oriented activities (11). This approach empowers instructors to adopt a more facilitative role, guiding students through collaborative problem-solving exercises, case analyses, and discussions (12).

Originally introduced by high school teachers, the flipped classroom aligns with Bloom's learning theory, which emphasizes the progression from basic understanding to higher-order thinking skills (13). By leveraging this methodology, educators can optimize classroom time for activities that promote critical thinking, clinical reasoning, and practical skills, ultimately improving the learning process as a whole (14). Furthermore, the flipped classroom's dynamic nature makes it particularly suitable for addressing complex topics and facilitating hands-on learning experiences, which are integral to nursing education (15). While the flipped classroom model has gained widespread use in global medical education, its adoption and effects in Iranian nursing programs have received limited attention. There is limited evidence regarding its effectiveness, outcomes, and challenges in this specific context, highlighting the need for a systematic synthesis of available studies. A systematic review was undertaken to comprehensively identify, critically appraise, and synthesize the available evidence on flipped classroom interventions in Iranian nursing education. This methodology enabled a rigorous assessment of study quality, comparison of reported outcomes, and identification of gaps in the existing literature to inform future educational practice and policy. Accordingly, the review was guided by the following research questions.

The primary question was: What evidence exists regarding the effectiveness of the flipped classroom model in nursing education in Iran?

The secondary questions were: How has the flipped classroom model been implemented within Iranian nursing education? What outcomes—such as knowledge acquisition, critical thinking, readiness for self-directed learning, satisfaction, motivation, learning approaches, and academic performance—have been reported? Additionally, what facilitators and challenges, including

those related to virtual delivery during the COVID-19 pandemic, have been identified in the implementation of the flipped classroom approach?

Consequently, this systematic review aimed to examine the evidence related to both the implementation and effectiveness of the flipped classroom model in the context of Iranian nursing education.

Methods

Study Design

A systematic review protocol was developed to investigate the impact of the flipped classroom approach on nursing education in Iran. The study adhered to the guidelines outlined in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework (16). Additionally, the protocol was registered on PROSPERO under the identification number CRD42022380857.

Search Strategy

A comprehensive literature search was conducted with the assistance of a professional librarian across several databases, including PubMed, Scopus, SID, Magiran, and MEDLINE. Google Scholar was also utilized to minimize the risk of missing relevant studies. The search strategy included the following terms: ("Flipped classroom" [tiab] OR "Flipped learning"[tiab] OR "inverted learning"[tiab] OR "Backward class" [tiab] OR "Reverse instruction" [tiab] OR "Reversal Learning"[tiab]) AND ("medical education" [tiab] OR "nursing" [tiab] OR "nursing education" [tiab] OR "academic skills" [tiab] OR "academic literacy" [tiab] OR "nursing student" [tiab])

Selection Criteria

Studies were included if they involved Iranian nursing students, encompassing both undergraduate and postgraduate levels. Both qualitative and quantitative studies, as well as mixed-method designs, published between 2012 and 2021 were considered. The time frame of 2012–2022 was selected to capture the emergence and growth of the flipped classroom model in nursing education, as the approach was first popularized in higher education following Bergmann and Sams' seminal work (17), while extending to 2022 allowed inclusion of studies conducted during the COVID-19 pandemic that accelerated virtual flipped implementations (18). The flipped classroom approach had to be implemented as either an exposure or intervention, with comparison groups potentially receiving traditional lecture-based instruction. Quantitative studies required measurable outcomes. Articles published in either English or Persian were eligible for inclusion.

Exclusion criteria comprised studies conducted in disciplines other than nursing, those not featuring the flipped classroom as an intervention or exposure, and those utilizing alternative educational models. Reviews, meta-analyses, letters to the editor, editorials, brief reports, case reports, pilot studies, preliminary investigations, and short communications were also excluded.

Data Extraction

Data extraction was conducted using a structured format, capturing key details such as author, year, study type, participants, subject, analysis methods, quality assessment scores, and main findings.

Quality Assessment

The quality of nonrandomized interventional studies was evaluated using the Joanna Briggs Institute Meta-Analysis Of Statistics Assessment And Review Instrument (JBI-MAStARI) critical appraisal tool, consisting of nine items with a maximum score of nine (19). Observational studies were assessed using the Strengthening The Reporting of OBservational Studies in Epidemiology (STROBE) statement (20), while qualitative studies were appraised using the Kmet standard criteria, with a maximum score of 20 (21). Two reviewers independently assessed the quality of included studies, with any discrepancies resolved through discussion or consultation with a third reviewer.

Data Synthesis and Analysis

Data were extracted from the included studies using a standardized form capturing author(s), publication year, study type, participants, subject, quality assessment scores, and main findings. A narrative synthesis approach was employed to summarize and integrate the findings, given the heterogeneity of study designs, interventions, and outcome measures. Quantitative outcomes (e.g., knowledge, critical thinking, self-directed learning readiness, satisfaction, motivation, learning approaches, average scores) were tabulated and compared across studies, while qualitative findings were thematically analyzed to identify common patterns, implementation strategies, challenges, and facilitators. The synthesis aimed to provide a comprehensive overview of the effectiveness and application of the flipped classroom model in Iranian nursing education.

Results

The findings of this systematic review are organized into several sections, covering the characteristics of the included studies, demographic characteristics of the participants, assessed outcomes, implementation in the context of the COVID-19 pandemic, and the quality assessment of the evidence.

Characteristics of Included Studies

The initial search yielded a total of 845 articles. Following the removal of duplicates (n=602) and screening of titles and abstracts (n=174), 69 articles underwent full-text assessment. Subsequently, 56 articles were excluded, resulting in the inclusion of 12 articles for analysis. Among these, 10 were quasi-experimental studies, one was descriptive, and one was qualitative. Additionally, the duration of flipped classroom sessions varied, ranging from 45 to 120 minutes per session, with some sessions accommodating participants' preferences. The study selection process is depicted in Figure 1.

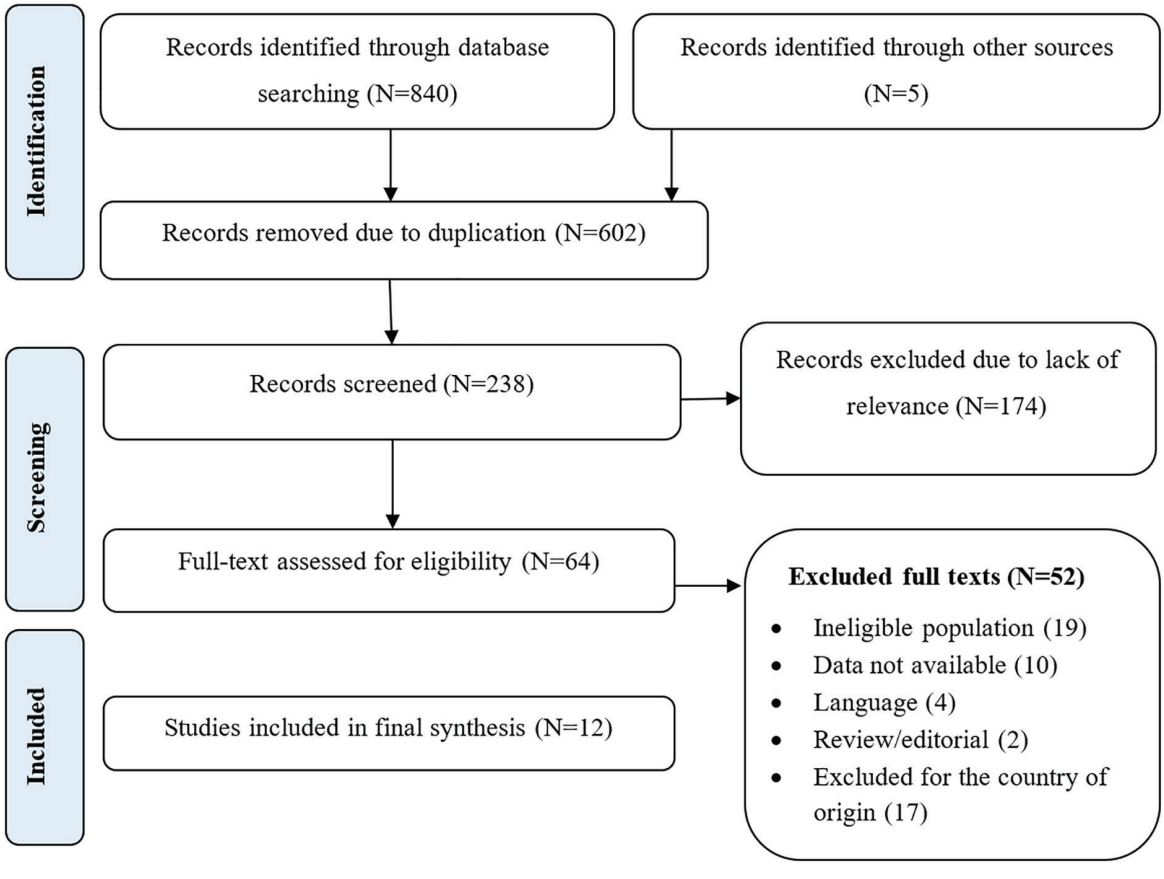

Figure 1: PRISMA Flowchart of selected studies

Participant Demographics

The included studies comprised a total of 588 participants, all of whom were undergraduate nursing students. Notably, two studies evaluated the impact of the flipped classroom approach on both nurses and midwives concurrently. Sample sizes across the studies varied, with participant numbers ranging from 34 to 102.

Outcome Measures

The included studies reported diverse outcomes, including self-directed learning readiness (22, 23), satisfaction with the intervention (24, 25), motivation (26), knowledge (27), critical thinking (28, 29), learning approach (30) and average scores (14). Various assessment tools were utilized, such as the Self-Directed Learning Readiness Scale for Nursing Education (SDLRSNE), Metacognitive Awareness Inventory (MAI), Revised Two-Factor Study Process Questionnaire (R-SPQ-2F), Ricketts' Critical Thinking Disposition Inventory, and the Patient Safety Knowledge Retention Exam (PSKRE), among others.

COVID-19 and Flipped Education

Only two studies examined the implementation of virtual flipped classrooms during the COVID-19 pandemic (22, 26).

Quality Assessment

none of the included studies were excluded on the basis of poor methodological quality. Overall, the appraisal indicated that all studies met acceptable quality standards for inclusion. A detailed summary of the quality assessment outcomes for each study is provided in Table 1.

Thematic Synthesis of Results

Knowledge and Academic Performance

Several studies reported significant improvements in knowledge and academic performance following the flipped classroom (14, 24, 27). Students in flipped groups consistently achieved higher post-test and course scores compared with traditional approaches.

Self-Directed Learning and Motivation

Multiple studies highlighted gains in self-directed learning readiness and academic motivation, particularly in intrinsic and extrinsic domains (22, 23, 26). However, certain subdomains such as self-management and metacognitive awareness did not show significant change, indicating partial rather than comprehensive improvement.

Table 1: Overview of the included studies

	Author, Year, Ref.	Study Type	Participants	Educational Level	Subject	Analysis Methods	QAS	Findings/ Results
1	Khodaei and colleagues (2022) (22)	Clinical Trial	N:34 F:14 M:20	Undergraduates	Respiratory, Cardiovascular, and Kidney Disorders	Paired t-test	8/9	• Significant improvement compared to before the intervention by taking part in flipped classrooms. • Increased mean score of self-directed learning readiness (P=0.0004). • No significant alteration in metacognitive awareness (P=0.15) and the mean total score of self-directed learning readiness (P=0.07).

	Author, Year, Ref.	Study Type	Participants	Educational Level	Subject	Analysis Methods	QAS	Findings/ Results
2	Golaki and colleagues (2022) (31)	Randomized Clinical Trial	N=82 F:51 M:31	Undergraduates	Not reported	Kruskal-Wallis test, Chi-square test, and the Fisher's exact test, paired and independent t-Test	23/25	• No significant difference in the groups after intervention (P=0.130, F=1.941).
3	Rooeintan and colleagues (2021) (24)	Clinical Trial	N:102 F:66 M:36	Undergraduates	ECG	Paired t-Test and Chi-square	7/9	• Significant difference between the scores of pre-test and post-test after flipped classroom (P=0.000, d=1.13, r=0.49). • Satisfaction with the method among 82.4% of participants. • No significant difference in terms of demographic variables (P>0.05).
4	Tohidi and colleagues (2021) (25)	Descriptive	N:40 F:21 M:19	Undergraduates	Blood tests and extravasation complications	Not reported	21/22	• 100% satisfaction with flipped classroom among participants. • No significant association of age and gender with satisfaction (P=0.4 and 0.15, respectively).
5	Haftador and colleagues (2021) (26)	Clinical Trial	N:84 F:44 M:40	Undergraduates	NR	Independent t-test, chi-square test and paired t-test	8/9	• Significant improvement of the level of academic motivation (P=0.002) and its intrinsic (p=0.003) and extrinsic (p=0.031) components after intervention. • Significant improvement of academic motivation (P=0.007) and its intrinsic (P=0.038) and extrinsic (P=0.010) components in the intervention group compared with the controls.

	Author, Year, Ref.	Study Type	Participants	Educational Level	Subject	Analysis Methods	QAS	Findings/ Results
6	Mirdehghan and colleagues (2021) (27)	Clinical Trial	N:60 F:32 M:28	Associates and undergraduates	Medical Equipment	T-test	8/9	• Better post-test scores in flipped classroom group (P<0.05). • Significant difference in the mean score of knowledge (P<0.05). • Improvement in the scores related to using equipment in the intervention group (P=0.000) .
7	Dadgari and colleagues (2020) (23)	Clinical Trial	N=36 F:18 M:18	Undergraduates	Pediatric disorders	Paired t-test	7/9	• Improvement of self-directed learning readiness after intervention (P=0.004). • Significant difference regarding interest in learning (P=0.001). • no significant difference in self-control and self-management domains (P>0.05).
8	Dehghanzadeh S, Alizadeh S (2018) (32)	Qualitative	N:18 F:12 M:6	Undergraduates	Orthopedic diseases	Conventional content analysis method	18/20	• Different learning style, control over learning, higher engagement of the mind in learning process, developing critical thinking as the most prominent qualities of flipped learning . • Introducing the flipped learning as a step toward higher level of professionalism. • large scale of the electronic contents as a barrier toward the successful implementation of flipped learning. • flipped learning as a tool to reinforce the team work.

	Author, Year, Ref.	Study Type	Participants	Educational Level	Subject	Analysis Methods	QAS	Findings/ Results
9	Dehghanzadeh and colleagues (2018) (28)	Clinical Trial	N=43 F:35 M:8	Undergraduates	Musculoskeletal disorders	One-sample t-test, paired t-test, Pearson correlation coefficient, and ANOVA	7/9	• Significant increase in total critical thinking disposition and the domain of intellectual engagement after intervention (P=0. 0001).
10	Dehghanzadeh S (2018) (30)	Clinical Trial	N:46 F:32 M:14	Undergraduates	Orthopedics	Independent t-test, paired t-test and Pearson correlation	8/9	• Significantly increased deep learning approach (P<0.001). • significant negative correlation between deep learning and superficial learning before (r = -0.29, P = 0.047) and after (r = -0.34, P = 0.015) the implementation of the flipped classroom method.
11	Dehghanzadeh S, Jafaraghaee F (2018) (29)	Clinical Trial	N:43 F:35 M:8	Undergraduates	Musculoskeletal Medical-Surgical Nursing	Paired-sample t, independent-sample t, and Chi-square tests	8/9	• Improvement of critical thinking disposition (P < 0.0001).
12	Jafaraghaie and colleagues (2017) (14)	Clinical Trial	N:43 F:35 M:8	Undergraduates	Motor disorders	Independent t-test and one way ANOVA	7/9	• Significant and positive correlation between students' views and the average scores (r=0.88, P=0.001). • No significant correlation between students' view and demographic data.

*QAS: Quality Appraisal Score (Total Points Earned / Total Points Possible); N: Sample size; F: Female; M: Male; ECG: Electrocardiography; ANOVA: Analysis of Variance.

Critical Thinking and Learning Approaches

Flipped classrooms were linked to enhanced critical thinking disposition (28, 29), and deeper learning approaches (30), suggesting a shift toward higher-order cognitive engagement.

Satisfaction and Perceptions

High levels of student satisfaction were consistently reported, with some studies showing near-universal approval (25). Qualitative evidence (29) further revealed that students valued the autonomy, teamwork, and professionalism fostered by flipped learning.

Implementation during COVID-19

Two studies explored virtual flipped classrooms during the pandemic (22, 26), reporting feasibility and positive outcomes but also highlighting challenges related to electronic content and delivery.

Challenges and Limitations

Despite overall benefits, barriers included large-scale preparation of electronic content, variability in session duration (45–120 minutes), and occasional non-significant effects in domains such as metacognition and superficial learning. Table 1 shows more details regarding the included studies.

Discussion

This study aimed to explore the effects of the flipped classroom approach on nursing education in Iran. Addressing the main research question on the effectiveness of flipped learning, the findings indicated that this approach enhanced students' readiness for self-directed learning and increased their interest in learning. However, no significant changes were observed in the self-control and self-management domains (23). This finding is consistent with the 2018 study by Ceylaner and colleagues, which demonstrated a significant improvement in self-directed learning readiness following the implementation of flipped classrooms (33). However, a study by Bagheri and colleagues (2016) found no significant improvement in overall self-directed learning readiness, although a significant enhancement was observed in the self-management domain (34). Another study by El Seesy and colleagues on nursing students in 2017 proved that self-control and interest in learning improved significantly (35). Similarly, Sallhorn and colleagues (2017) reported that while flipped education may enhance student participation and motivation, it does not produce a significant improvement in learning outcomes (36). However, it is reported by Talebi and colleagues in 2016 that students at higher semesters were more ready to participate in flipped classrooms (37).

Regarding the secondary question on demographic variables, the findings of the present study showed no significant relationship between flipped classroom outcomes and demographic variables (14, 24). one study reported greater effectiveness of the flipped classroom approach among male students than female students (28), indicating the need for further research to better elucidate these associations. Regarding the secondary question on student satisfaction and motivation, the findings showed that students generally expressed satisfaction with the flipped classroom approach (24, 25). In contrast, a systematic review and meta-analysis by Låg and Sæle in 2019 showed that students' satisfaction with flipped classroom was not significant (38). Similarly, McLaughlin and colleagues in reported in 2014 that approximately 90% of pharmacy student declared the materials in flipped classroom were helpful (39). However, a Brazilian study on nursing students by Menegaz and colleagues in 2018 was indicative of mixed results, because there was low level of participation in flipped classrooms (40). These findings emphasize that the success of flipped classrooms depends on proper implementation, including practical content, adherence to instructional principles, and student preparation, as highlighted by El-Banna (41), Chan and colleagues (42), and Bergmann and colleagues (17). Additionally, Rodrigues and Zealand (2016) underscored the importance of sustaining student motivation (43).

Panicker (2018) further demonstrated that flipped classrooms can enhance student engagement and create online learning environments that facilitate feedback, ultimately improving academic performance (44). However, the effectiveness of this approach may be compromised if students are insufficiently prepared, underscoring the necessity for learners to engage with assigned materials, such as instructional videos, in advance (45). Consequently, the development of concise educational videos is particularly important, given their direct association with student satisfaction (46).

Besides, there is desperate need for a valid tool for the evaluation of the flipped classrooms. For instance, quizzes are known as a tool to appraise the level of students' understanding (47), and frequent quizzing has been shown to enhance student performance in flipped settings (48). Studies conducted in Iran have primarily focused on undergraduate populations; however, flipped classrooms in higher education have also been shown to support deep learning among postgraduate students, particularly by facilitating review and reflection (49).

Uzunboylu and Karagozlu (2015) reported high levels of satisfaction among postgraduate learners using the flipped classroom model (50). By focusing on flipped education in post-graduate learners, their weaknesses are identified and they can even discuss the subjects (39). However, adequate hardware and software infrastructure is required, making institutional resources critically important (51).

One challenge associated with flipped classrooms is that some learners may lack sufficient motivation due to the nature of the instructional approach itself (52). Effective implementation of flipped learning also depends on adequate support for educators, highlighting the need for collaboration between university leadership and faculty members (53). Additionally, instructors must clearly communicate the learning objectives of the curriculum within the flipped classroom (54). It has been noted that many educators resist transitioning from traditional teaching methods to flipped learning, as they may feel somewhat sidelined in the new approach (55). Educators need to develop skills that allow students to independently engage with the material. Furthermore, flipped classrooms are said to encourage educators to reflect on and adapt their teaching methods and attitudes (53).

A more in-depth analysis of the Iranian context reveals cultural and systemic factors that may influence the effectiveness of flipped classrooms. For instance, the collectivist culture in Iran may enhance group-based activities during in-class sessions, as evidenced by Yin and colleagues (56), who reported improved teamwork and peer interaction. However, this cultural orientation may also create resistance to pre-class individual preparation if students perceive it as an additional burden without immediate group reinforcement. A recent study by Darabi and colleagues (2023) in an Iranian medical university found that students from lower socioeconomic backgrounds had significantly lower completion rates of pre-class materials due to limited access to high-speed Internet and personal devices, highlighting a digital divide that was not adequately addressed in the reviewed studies (57). This suggests that equity in access to technology must be a prerequisite for successful flipped classroom implementation in Iran.

Additionally, two studies provide valuable insights into the adaptability of flipped classrooms in crisis situations (58, 59). While both reported positive outcomes in motivation and self-directed learning, they also noted increased student anxiety due to the sudden shift to fully online formats. A 2024 meta-analysis by Hew and colleagues on virtual flipped classrooms in health professions education during the pandemic confirmed that while knowledge retention improved, student burnout increased by 18% when pre-class videos exceeded 20 minutes or when real-time interaction was limited (60). Iranian nursing programs could mitigate this by adopting hybrid models that combine short, high-quality video content with structured

synchronous discussions.

Another critical gap is the lack of longitudinal studies. None of the included studies assessed whether gains in critical thinking or self-directed learning persisted beyond the immediate post-intervention period. A quasi-experimental study followed nursing students found that while critical thinking scores remained elevated at 6 months, they regressed to baseline by 12 months without reinforcement activities (28). This suggests that Iranian nursing curricula should integrate periodic "flipped refreshers" or clinical simulation modules to sustain long-term benefits.

Faculty development plays a crucial role in supporting effective teaching. According to the qualitative study by Bakla and colleagues (54), instructors reported feeling inadequately prepared to create engaging in-class activities (61). A 2023 systematic review by Betihavas and colleagues highlighted that the primary global barrier to implementing flipped teaching is insufficient training in facilitating active learning (8). In Iran, where nursing faculty are often overloaded with clinical and administrative responsibilities, focused workshops on flipped classroom methods—potentially organized by the Iranian Nursing Organization—could help speed up its adoption.

Lastly, the lack of postgraduate research restricts the ability to generalize the findings. In Iran, postgraduate nursing students—many of whom are practicing nurses—experience particular challenges related to time constraints. A randomized controlled trial by Cunha and colleagues investigating flipped learning among master's-level nurses found that short micro-learning modules (lasting 5–7 minutes) delivered through mobile applications significantly enhanced both satisfaction and knowledge retention compared to conventional webinars (62). Iranian nursing schools could adapt this mobile-first approach for postgraduate continuing education, taking advantage of the widespread smartphone usage across the country.

Limitations and Suggestions

This review had several limitations. It excluded grey literature and non-English/Persian studies, which may have led to missing relevant data. The search period was limited to 2012–2021, potentially overlooking recent research. Besides, most studies focused on undergraduate nursing students, with little evidence on postgraduate learners. Future research should include broader sources, explore demographic factors, and assess flipped classrooms in postgraduate settings. Additionally, standardized evaluation tools and stronger infrastructure are needed to improve implementation and outcomes.

Conclusion

This was the first systematic review to synthesize the evidence regarding the effect of flipped classrooms on Iranian nursing students. This review highlighted that most of the researches in this area adopted a quasi-experimental design. The findings suggest that flipped classrooms may enhance knowledge acquisition among Iranian nursing students, though further research is needed. These results highlight the importance of adopting more effective teaching methods, positioning the flipped classroom as a promising learning strategy for nursing education. The majority of the included studies emphasized the need to focus more on nursing students by offering them innovative classroom environments and learning techniques. For the future researches, it is recommended to conduct the related studies on graduate and post-graduate nursing students in Iran. Additionally, such method can be implemented among nurses working at the hospitals for their retraining courses.

Abbreviations

JBI-MAStARI: Joanna Briggs Institute Meta-Analysis of Statistics Assessment And Review Instrument.

PRISMA: Preferred Reporting Items for Systematic reviews and Meta-Analyses.

STROBE: Strengthening the Reporting of Observational Studies in Epidemiology.

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The authors affirm that the content of this publication was not generated using a generative or big language model (like ChatGPT or other technologies). Only modest language and grammatical checks were performed by AI tools under the authors' supervision. The writers are solely responsible for all concepts, evaluations, and citations.

Authors' Contribution

MJB and AR were involved in conceptualizing the idea, performing the thematic analysis, creating data visualizations, and drafting the initial version of the paper. MSh and FN acted as supervisors. MP, NSh, and PD contributed to drafting and revising the manuscript, as well as managing the project. All authors reviewed and accepted the final version of the manuscript.

Conflict of Interest

The authors declare that no competing interests exist.

Ethical Considerations

This study was conducted in accordance with ethical standards and was approved by Behbahan University of Medical Sciences, Behbahan, Iran, under the ethical approval code IR.BHN.REC.1402.038. As a review article, it synthesized and analyzed existing published data and literature, and therefore did not involve direct data collection or interaction with human subjects.

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Availability of Data and Materials

All data collected and analyzed during this study are included within the article and public sources.

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