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The Effects of Competency-Based Education on Knowledge and Clinical Competence among Nursing Students and Nurses: A Systematic Review

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Abstract

Introduction: Competency-based education (CBE) is a contemporary teaching approach with potential impacts on clinical competence (CC). This study aimed to review and synthesize the best empirical evidence in order to evaluate the effects of CBE on knowledge and CC among nursing students and nurses.

Methods: This systematic review included studies published between 2009 and 2024 that investigated the effects of CBE in nursing. An online search was performed in the Proquest, Science Direct, Scopus, PubMed, Google Scholar, SID, Magiran, and IranMedex databases. The quality of the selected articles was assessed using the Cochrane checklist was sued for experimental studies and the Greenhalgh and colleagues' Critical Appraisal checklist for quasi-experimental studies. Fourteen studies were included.

Results: The included studies had reported the positive significant effects of CBE on cognitive and behavioral skills, CC, learning satisfaction, special and general clinical performance, academic efficacy, metacognitive abilities, communication skills, and cognitive load among nursing students and nurses.

Conclusions: CBE significantly enhances knowledge and CC in nursing students and nurses. Nursing education authorities can use CBE to develop and implement the nursing curriculum and thereby improve the effectiveness of clinical education.

INTRODUCTION

Nursing education in the 21th century faces ongoing changes due to evolving healthcare systems, advances in healthcare technology, and the increasing diversity of different chronic conditions [1]. Therefore, it is essential to train nurses with strong clinical competence (CC) to ensure patient safety and improve quality of life [2].

CC is defined as a set of knowledge, skills, attitudes, and abilities for providing safe and effective care without the need for others' supervision and surveillance [3]. Nurses' CC is a key factor in patient safety, patient satisfaction, care quality [4], and patient outcomes. One study reported that limited CC among nurses significantly increases patients mortality [5]. Nonetheless, a study showed that almost 49% of novice nurses committed nursing errors due to limited CC [6]. Developing CC remains a major challenge in nursing education. For example, a study in Iran showed that 76.6% of nursing instructors believed in the clinical incompetence of master's degree graduates [7]. Master's degree graduates in a study in Italy also reported that their education mainly focused on teaching, management, and research skills and paid little attention to clinical skills [8]. Another study on graduate nurses in Malaysia showed that 65% of them had limited clinical skills, 55% of them lad limited perceived self-

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confidence and professional skills to apply job in other countries, and 65% of them reported very limited English and communication skills [9]. These challenges partly result from traditional teaching methods failing to effectively develop clinical skills [10].

Competency-based education (CBE) or outcome-based education is one of the methods for CC promotion among nurses. As a modern teaching method in nursing, CBE is considered as an outcome-based method for developing, implementing, assessing, and evaluating educational programs [11]. It ensures whether graduates possess essential knowledge, skills, and attitudes for starting professional practice [12]. The aim of CBE is to identify and promote learners' physical, mental, and emotional abilities and to help them achieve professional success [13]. In CBE, the main focus is on outcome, effectiveness, quality, and learners' accountability and the main criterion for evaluation is learners' abilities and attitudes [14]. The World Health Organization also recommends CBE as an approach to reduce theory-practice gap among healthcare graduates [15].

Two studies showed that CBE significantly promoted nursing students' CC [16, 17]. A study into the effects of CBE in nursing education also reported that it considerably facilitated educational progress and reduced education-related costs but was associated with considerable challenges for university instructors and managers [18] .The results of a systematic review also showed that this approach significantly improved nursing students' competence in developing their knowledge and cognitive, clinical, and nursing skills [19]. However, that review study only included six studies and hence, its findings did not provide firm evidence respecting the effects of CBE [20]. Therefore, further studies are still necessary in this area. The present study was conducted to narrow this gap. The aim of this study was to review and synthesize the best empirical evidence in order to assess the effects of CBE on knowledge and CC among nursing students and nurses.

METHODS

This review study was conducted in 2024 and registered in PROSPERO (CRD 1176800). The systematic review was guided by the PRISMA checklist (Supplementary File 1). English and Persian databases, namely ProQuest, ScieneDirect, CINAHL, Scopus, PubMed, Google Scholar, SID, Magiran, and IranMedex were searched for interventional studies into the effects of CBE published between 2009 and 2024. Search keywords were "nursing", "nursing students", "nurse", "baccalaureate nursing students", "nursing graduates", "competence-based education", "outcome-based education", "competence-based approach", "outcome-based approach", and "competence-based teaching learning method". Two of the study authors determined the keywords using the Medical Subject Headings (MeSH) and independently searched them in the above-mentioned databases. Inclusion criteria were interventional design, student participants, use of CBE in the intervention group, publication in English or Persian, accessible full-text, and no zero score for the items of the quality appraisal instrument. Letters to the Editor, commentaries, dissertations, and abstracts were not included in the study.

Quality Appraisal

Two authors independently assessed the quality of the retrieved studies, and any disagreements were resolved by discussion. The six-item Cochrane checklist was sued for experimental studies and the eight-item Greenhalgh and colleagues' Critical Appraisal checklist for quasi-experimental studies [21]. The items of these checklists were scored as either zero ("Not addressed"), 1 ("Implicitly addressed"), or 2 ("Explicitly addressed") (Table 1).

Table 1. Quality appraisal scores of the reviewed studies

Quasi-experimental study	Zaker et al. 2018	Khodaei et al. 2018	Hoseini et al. 2017	Esmaeil Zadeh et al. 2017	Soheili et al. 2015	Fan et al. 2015	Soheili et al. 2015	Wu et al. 2014	Kavosi et al 2013	Nadery et al. 2011	Baghaei et al 2011	Valizadeh et al 2009	Experimental study	Hsu et al. 2019	Hsu et al. 2016
Research question/design	2	2	2	2	2	2	2	2	2	2	2	2	Concealment of allocation	2	2
Intervention	1	1	1	1	1	2	1	2	2	2	2	1	Follow-up of all samples	2	2
Sufficient data points	2	1	2	1	2	2	2	2	1	1	1	1	Blinded assessment of primary outcome(s)	1	1
Statistical tests	2	2	2	2	2	2	2	2	2	2	2	2	Baseline comparability of groups	2	2
Outcome measures	2	1	2	1	2	2	2	1	2	2	1	2	Outcome measures	2	1
Data collection	2	2	2	2	1	2	1	1	2	2	2	2		1	1
Completeness of data set	2	2	1	2	2	1	2	1	2	2	2	2	Protection against contamination		
Long enough follow-up	1	1	1	1	1	1	1	2	2	1	1	1			

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Table 2. The Characteristics of the Reviewed Studies

Author,Year	Title	Sample	Design	Control group	Method in the control group	Main findings
Hsu et al. 2019 [22]	An outcome-based educational intervention to improve nursing students' knowledge and competencies in oncology nursing: a randomized controlled trial	Nursing students (Neurology) n = 213	Pretest-posttest experimental	Yes	Traditional	Significant positive effects of outcome-based education on knowledge, CC, cognitive load, learning satisfaction, and self-confidence
Khodaei et al. 2018 [23]	Competency-based mastery learning: a planned clinical experience for nursing students	Nursing students (Dialysis) n = 28	Pretest-posttest quasi-experimental	Yes	Traditional	Significant positive effects of CBE on knowledge and skills
Hoseini et al. 2018 [24]	Comparing the effects of CBE and lecture on the knowledge and performance of nurses in the field of hospital triage	Nurses (Triage) n = 75	Pretest-posttest quasi-experimental	Yes	Traditional	Significant positive effects of CBE on performance
Zaker et al. 2017 [17]	The effects of CBE on cognitive and clinical skills of nursing students	Fourth-year nursing students (Dialysis) n = 52	Pretest-posttest quasi-experimental	Yes	Traditional	Significant positive effects of CBE on cognitive and behavioral skills and CC
Esmaeilzadeh et al. 2017 [25]	Development of CBE in nursing students education	Nursing students (ICU) n = 28	Pretest-posttest quasi-experimental	Yes	Traditional	Significant positive effects of CBE on knowledge and clinical skills
Hsu et al. 2016 [26]	Randomized comparison between objective-based lectures and outcome-based concept mapping for teaching neurological care to nursing students	Nursing students (Neurology) n = 213	Pretest-posttest experimental	Yes	Objective-based lecture	Significant positive effects of outcome-based education on cognitive load and learning satisfaction and its insignificant effects on CC
Soheili et al. 2015 [27]	The effect of implementing CBE on nursing students' clinical performance in coronary care unit	Fourth-year nursing students (CCU) n = 34	Posttest-only quasi-experimental	Yes	Traditional	The greater effectiveness of CBE than traditional teaching in improving special and general clinical performance
Fan et al. 2015 [28]	Performance evaluation of nursing students following CBE	Second-year nursing students (Medical-surgical) n = 312	Pretest-posttest quasi-experimental	Yes	Traditional	The positive effects of CBE on academic performance, academic efficacy, CC, and metacognitive abilities
Soheili et al. 2015 [29]	The effects of implementing CBE on nursing student' communication skills	Fourth-year nursing students n = 34	Posttest-only quasi-experimental	Yes	Traditional	Significant positive effects of CBE on CC
Wu et al. 2014 [30]	Application of nursing core competency standard education in the training of nursing undergraduates	Fourth-year nursing students n = 73	Posttest-only quasi-experimental	Yes	Traditional	Significant positive effects of CBE on the history taking, physical examination, scenario simulation, and communication skills
Kavosi et al. 2013 [31]	The effects of a CBE program on nurses' practice in cardiopulmonary resuscitation in emergency department	Nurses (Emergency department) n = 30	Pretest-posttest quasi-experimental	Yes	Traditional	Significant positive effects of CBE on cardiopulmonary resuscitation performance immediately and four months after the intervention
Nadery et al. 2011 [32]	Comparison of the effects of CBE and traditional teaching on learning cognitive and clinical skills among ICU nursing students	Fourth-year nursing students (ICU) n = 28	Pretest-posttest quasi-experimental	Yes	Traditional	Significant positive effects of CBE on cognitive and clinical skills
Baghaei et al. 2011 [16]	Competency-based learning mastery model: a planned clinical experience for nursing students	Fourth-year nursing students (ICU) n = 28	Pretest-posttest quasi-experimental	Yes	Traditional	Significant positive effects of CBE on knowledge, skills, and CC
Valizadeh et al. 2009 [33]	The effects of outcome-based education on nursing students' clinical competency	Fourth-year nursing students (Dialysis) n = 26	Pretest-posttest quasi-experimental	Yes	Traditional	Significant positive effects of outcome-based education on cognitive and behavioral skills and CC

Data Extraction and Synthesis

In total, 342 records were found, while only fourteen articles were eligible for the study (Figure 1). The second author extracted data from the articles about their setting, year of publication, sample size, design, and findings, and analyzed them using a descriptive method (Table 2). Then, other authors assessed the process of data extraction and synthesis, and any disagreements were resolved by discussion. No statistical analysis was performed on the extracted data due to the considerable heterogeneity among the articles.

RESULTS

The fourteen studies included in this review study consisted of eight published in English and six in Persian. Twelve studies compared CBE with traditional teaching methods, one study compared CBE and lecture with traditional methods, and another compared outcome-based education with goal-oriented lectures.

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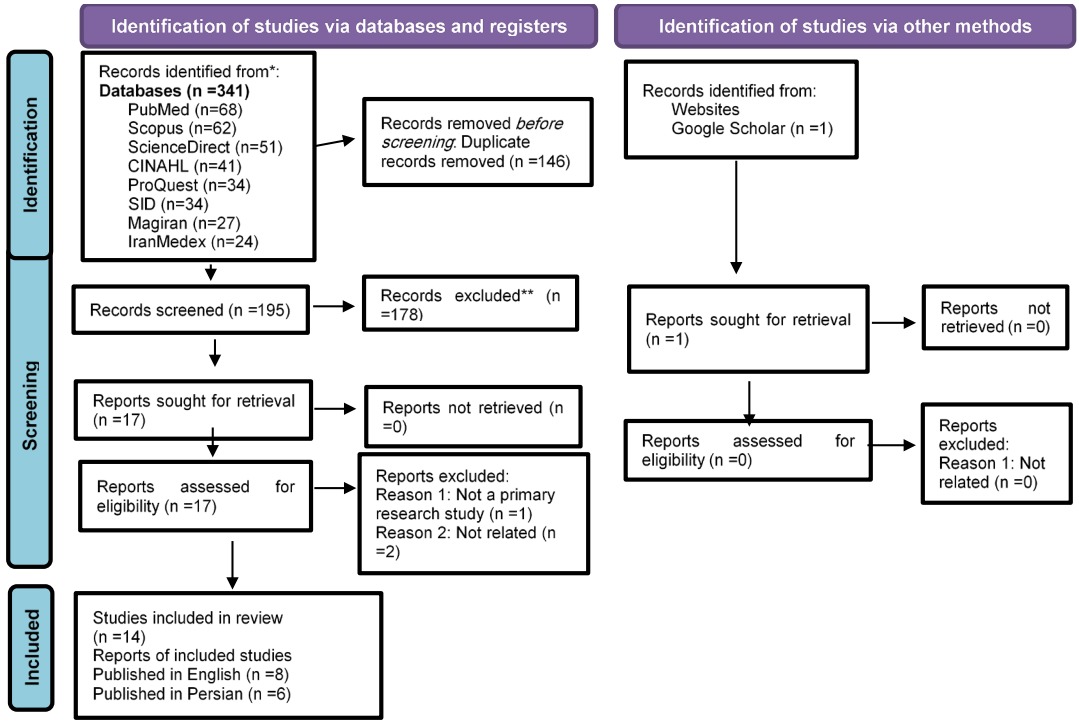


Figure 1. PRISMA diagram for the search and selection process of articles (near here)

1. Characteristics of CBE Programs

1.1 Origin of the Studies

Ten studies were conducted in Iran [16, 17, 23-25, 27, 29, 31-33], three in Taiwan [22, 26, 28], and one in China [30].

1.2. Topics

The effects of CBE had been assessed in the following main areas:

Coronary care (one study) [27];
Intensive care (three studies) [16, 25, 32];
Dialysis (three studies) [17, 23, 33];
triage and cardiopulmonary resuscitation (two studies) [24, 31];
Medical-surgical nursing (one study) [28];
Neurologic care (one study) [26];
Oncology nursing (one study) [22];
Nursing curriculum (one study) [30]; and
Communication (one study) [29].

1.3. Period and Duration

The length of the CBE programs implemented in the reviewed studies widely varied (Table 2). Some studies had implemented CBE program in nine days [33], twelve days [25], and fourteen days [17], while the duration of CBE program in some studies was three weeks with nine sessions [32] and four weeks [16, 23, 24, 27]. Other studies had implemented CBE in sixteen hours in one month [26], in four months [31], and in a whole semester [28]. One study had implemented a 3699-hour CBE program throughout a whole baccalaureate program [30]. Two studies had not provided any data on the duration of their CBE programs [22, 29].

2. CBE Provision

CBE programs in the reviewed studies had mostly been implemented in four main phases. In the first phase, the basic educational needs and essential competencies for students had been determined through the modified Delphi method and using the comments of nursing instructors, head nurses, nursing supervisors in hospitals, and medical specialists. In the second phase, competencies had been standardized to determine students' roles and tasks and to develop the road map of the CBE programs. In the third phase, the CBE programs had been implemented in the intervention groups and the instructors of the groups had been provided with information about the necessity of adherence to the programs. In the fourth phase, the outcomes of the programs had been evaluated using self-report questionnaires, multiple-choice questions, and clinical performance checklists.

3. Methods Used in the Studies

3.1. Design

Two studies employed an experimental design [22, 26], nine used a pretest-posttest quasi-experimental design [16, 17, 23-25, 28, 31-33], and three used a posttest-only quasi-experimental design [27, 29, 30].

3.2 Samples

Sample sizes varied widely, ranging from 213 participants in experimental studies to between 26 and 312 participants in quasi-experimental studies. As

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shown in Table 2, twelve studies were conducted on nursing students [16, 17, 22, 23, 25-30, 32, 33] , while two studies focused on nurses working in emergency departments [24, 31].

3.3. Instruments

Different instruments had been used in the reviewed studies for the assessment of knowledge, skills, and CC. Most studies had used written exams for knowledge assessment, checklists for clinical practice assessment, and questionnaires for the assessment of satisfaction with teaching and learning. The content of the instruments varied according to the aims of the implemented CBE programs and had been developed using nursing textbooks, articles, and instructors' opinions. One study had used the Metacognitive Inventory for Nursing Students [28], one had used the Competency Inventory of Nursing students [26], and one had used the Cognitive Load Scale of Neurological Nursing for cognitive load assessment and the Learning Satisfaction Scale of Neurological Nursing for learning assessment [26]. Another study had employed the Knowledge Test of Cancer Nursing for assessing cancer-related knowledge according to Bloom's taxonomy, the Cognitive Load Scale of Cancer Nursing for assessing students' cancer-related cognitive load and mental stress, and the Learning Satisfaction and Self-Confidence Scale of Cancer Nursing for assessing satisfaction with learning and self-confidence among oncology nurses [22]. One of the studies had used the competencies approved by the Taiwan Nursing Accreditation Council as the criteria for assessment [28].

4. The Effects of CBE on Knowledge and Skills

Twelve studies reported the positive effects of CBE on knowledge and CC [16, 17, 23-25, 27-33].

One study reported that CBE improved not only special clinical performance, but also general clinical performance in the communication and education areas, while had no significant effects on documentation skill [27]. Another study reported the effectiveness of CBE in promoting students' academic performance and their metacognitive abilities and clinical skills [28]. A study which compared the effects of CBE and lecture found that although both methods were effective in improving knowledge, the effects of CBE on clinical performance were significantly greater than lecture [24].

Another study found no significant difference between the effects of outcome-based concept mapping and lecture on nursing competencies among nursing students while the mean score of cognitive load in the outcome-based concept mapping group was lower than the lecture group [26]. The same findings were observed in another study into the effects of outcome-based education [22]. The study into the effects of outcome-based concept mapping also showed that it helped clarify ideas, apply knowledge, and identify the healthcare problems and needs of hospitalized patients and improved nursing students' thinking abilities [26].

Two studies also reported the effectiveness of CBE in significantly enhancing students' satisfaction with learning [22, 26]. Moreover, a study found that although there was no significant difference between the effects of CBE and traditional methods on the mean score of the comprehensive theoretical knowledge examination, the mean scores of the history taking, physical examination, scenario simulation, and communication practical skills in the CBE group were significantly greater [30].

DISCUSSION

The aim of this review study was to evaluate the effects of CBE on knowledge and CC among nursing students and nurses. The findings indicate that CBE in nursing education can enhance professional knowledge, skills, and behaviors; increase satisfaction with learning; and support the development of communication skills and metacognitive abilities. Similar results have been reported in medical education. For instance, a study of 645 medical students in the United States found that competency-based pressure ulcer curriculum significantly improved competence scores in pressure ulcer management [34]. Another study of 175 first-year medical residents in Canada showed that a competency-based curriculum significantly enhanced professional knowledge, skills and the quality of education [35]. Similarly, a study on medical students showed the effectiveness of CBE in significantly enhancing their satisfaction with curriculum and learning [36].

CBE facilitates the attainment of the two main goals of education, i.e. determining and measuring the outcomes of learning [37]. Competency-based curriculum mainly focuses on improving the basic competencies of social life, including information processing, problem solving, critical thinking, systemic thinking, and lifelong learning capabilities and hence, helps educational authorities and managers increase the cost-effectiveness of education [38]. CBE is also essential for filling theory-practice gap because it focuses on learning outcomes, learners' accountability, practice-based learning, self-evaluation, and individualized learning experiences [39].

Traditional teaching mainly relies on the lecture method, in which instructors mostly transfer theoretical knowledge to students. However, theoretical knowledge transfer is a very small component of CBE because competence includes not only knowledge, but also ability, skill, attitude, and motivation. The most important advantages of CBE is the more precise identification of educational needs, improvement of education effectiveness, provision of applicable educations, and avoidance from mere knowledge transfer [40]. A phenomenological study showed that application of CBE in higher education helps integrate

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knowledge, attitude, and skills into the curriculum and encourages learners' engagement in learning through using different teaching methods such as lecture, seminars, projects, and simulation and using learner-centered evaluation techniques such as peer evaluation, case studies, and self-evaluation [41].

CONCLUSION

This study suggests that CBE is more effective than traditional methods in enhancing knowledge and promoting CC among nursing students and nurses. Therefore, it is recommended that nursing education authorities adopt CBE for curriculum development and implementation to improve the effectiveness of clinical education.

Limitations and Recommendations for Future Research

This systematic review reflects several limitations inherent in the current evidence on CBE in nursing. Most studies focused on small samples of nursing students in academic or simulated settings, with minimal representation of practicing nurses in real clinical environments, limiting the transferability of findings to the broader nursing workforce. Considerable heterogeneity existed across interventions in terms of duration, pedagogical approaches, clinical specialties (e.g., ICU, emergency, dialysis), and outcome measures -ranging from written exams to self-reports- hindering standardization and statistical synthesis. Moreover, few studies addressed the practical challenges of CBE implementation, such as resource constraints, faculty readiness, infrastructure needs, or organizational resistance to change. Critically, there is a lack of evidence on CBE's impact on generalist nursing competencies, soft skills (including emotional intelligence, ethical reasoning, and advanced communication), and higher-order professional capabilities like leadership, management, and research literacy—skills essential for graduate and advanced practice nurses. Finally, the potential for publication bias, with a likely overrepresentation of positive outcomes, may skew perceptions of CBE's effectiveness. To address these gaps, future research should: (1) employ robust mixed-methods or implementation science designs in diverse clinical settings with practicing nurses; (2) adopt standardized, validated frameworks (e.g., IOM or ICN competency domains) to assess both technical and non-technical competencies; (3) explicitly investigate systemic barriers and enablers of CBE adoption; and (4) prioritize transparent reporting of all outcomes - including neutral or negative findings- to ensure a balanced evidence base. Such efforts will be essential to realizing the full potential of CBE in transforming nursing education and practice globally.

Abbreviations

CBE: Competency-Based Education
CC: Clinical Competence

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AUTHORS' CONTRIBUTIONS

CRediT authorship contribution statement. Shahnaz Bolandianbafghi: Conceptualization; Data curation; Formal analysis; Investigation; Methodology; Project administration; Validation; Writing - original draft; Writing - review & editing. Zohreh Nabizadeh-Gharghozar: Conceptualization; Data curation; Formal analysis; Investigation; Methodology; Project administration; Supervision; Validation; Writing - original draft; Writing - review & editing. Arezoo Ghavi: Investigation; Methodology; Writing - review & editing. Armin Amanibani: Investigation; Methodology; Writing - review & editing.

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AVAILABILITY OF DATA AND MATERIALS

Data from journals used in this work found on publicly available repositories.

ETHICAL CONSIDERATION

Ethical approval and consent from participate are not applicable for this study.

CONFLICT OF INTERESTS

The authors declare that they have no competing interests.

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