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Enhancing Nursing Competency Through Outcome-Based Education: A Comprehensive Meta-Analysis

Khishigdelger Lkhagvaa, Basbish Tsogbadrakh, Gankhuyag Gochoosuren * and Oyungoo Badamdorj

School of Nursing, Mongolian National University of Medical Sciences, Ulaanbaatar, Mongolia.

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Abstract

Background: Outcome-Based Education (OBE) has been increasingly adopted in nursing education to enhance students' competencies, yet evidence on its global effectiveness remains heterogeneous. This meta-analysis quantitatively evaluates the impact of OBE interventions on clinical competency, knowledge acquisition, critical thinking, and self-efficacy among nursing students.

Methods: A systematic search was conducted in PubMed, CINAHL, Scopus, Web of Science, and Embase for studies published between 2010 and 2025. Eighteen studies (4 randomized controlled trials, 14 quasi-experimental) involving 3,820 nursing students were included. Standardized mean differences (SMDs) with 95% confidence intervals (CIs) were calculated using a random-effects model. Subgroup analyses were performed by intervention type (simulation-based, OSCE, traditional OBE). Heterogeneity was assessed with the I^2 statistic.

Results: OBE interventions significantly improved all four outcomes. Clinical competency showed a moderate-to-large effect (SMD = 0.68, 95% CI: 0.45–0.91, I^2 = 46%), critical thinking was moderately enhanced (SMD = 0.55, 95% CI: 0.32–0.78, I^2 = 38%), knowledge acquisition improved moderately (SMD = 0.49, 95% CI: 0.28–0.70, I^2 = 40%), and self-efficacy demonstrated moderate gains (SMD = 0.61, 95% CI: 0.39–0.83, I^2 = 35%). Subgroup analyses indicated that simulation-based programs yielded the highest effect sizes across outcomes (clinical competency SMD = 0.82; critical thinking SMD = 0.67; knowledge acquisition SMD = 0.55; self-efficacy SMD = 0.66), followed by OSCE and traditional OBE.

Conclusions: OBE is an effective educational strategy in nursing programs, enhancing both cognitive and practical competencies. Simulation-based and OSCE-integrated OBE interventions are particularly effective. Findings support the global adoption of competency-focused, outcome-driven curricula to optimize nursing education.

Keywords: Outcome-Based Education; Nursing Students; Clinical Competency; Critical Thinking; Knowledge Acquisition; Self-Efficacy; Meta-Analysis

1. Introduction

Outcome-Based Education (OBE) has emerged as a widely endorsed educational framework in health professions, emphasizing the attainment of clearly defined learning outcomes rather than traditional input-based teaching methods (Spady, 1994; Harden, 2007). Unlike conventional curricula, which often focus on content coverage and time-based progression, OBE prioritizes the demonstrable competencies of learners, including knowledge, practical skills, critical thinking, and self-efficacy (Tan, 2018). In nursing education, these competencies are essential for preparing graduates

* Corresponding author: Gankhuyag Gochoosuren

to deliver safe, evidence-based patient care in increasingly complex healthcare environments (Chen and Liu, 2022; Bold et al., 2015).

The integration of OBE in nursing curricula has gained momentum globally, with interventions ranging from structured classroom instruction to simulation-based and Objective Structured Clinical Examination (OSCE) formats (Chen et al., 2017; Park and Choi, 2019; Wu, 2022). Simulation-based learning and OSCEs provide students with opportunities to apply theoretical knowledge in realistic, controlled clinical scenarios, allowing repeated practice and immediate feedback, which are critical for skill acquisition and confidence building (Efendi, 2023; Guerrero, 2023; Hebel, 2025). Flipped classrooms, blended learning, and team-based learning have also been incorporated into OBE programs to foster active learning and higher-order cognitive skills (Chu, 2019; Fan, 2020; Ngoc, 2025).

Evidence from quasi-experimental and randomized controlled studies suggests that OBE interventions can enhance nursing students' clinical competencies, knowledge acquisition, critical thinking, and self-efficacy (Lkhagvaa et al., 2024; Mohebbi, 2023; Kumar et al., 2020). For example, simulation-based interprofessional education has been shown to improve critical thinking and collaborative decision-making among nursing and medical students (Chiara, 2022; Wu, 2022). Similarly, OSCE integration ensures that students can demonstrate practical skills under standardized conditions, bridging the gap between theoretical understanding and clinical performance (Garrido-Bueno, 2025; Liu, 2024).

Despite the growing adoption of OBE, the literature indicates variability in the magnitude of its effects, likely due to differences in intervention type, duration, educational context, and outcome assessment tools (Tan, 2018; Chen and Liu, 2022; Lkhagvaa, 2024). Previous reviews have been largely narrative or limited in scope, focusing on single competencies or regional implementations (Bold et al., 2015; Park and Choi, 2019). A comprehensive, quantitative synthesis of the global evidence is necessary to clarify the overall effectiveness of OBE in nursing education, identify moderators of intervention success, and guide curriculum design for maximum impact.

This meta-analysis aims to systematically evaluate the effects of OBE interventions on four core outcomes clinical competency, knowledge acquisition, critical thinking, and self-efficacy among nursing students worldwide. Specifically, it examines the relative effectiveness of simulation-based, OSCE, and traditional OBE interventions, explores the influence of program duration, and assesses the quality and risk of bias of included studies. By synthesizing evidence across diverse contexts, this study provides insights for educators, policymakers, and curriculum developers seeking to implement outcome-focused, competency-based strategies in nursing education.

2. Methods

2.1. Study Design

This study employed a systematic review and meta-analysis to evaluate the effectiveness of Outcome-Based Education (OBE) interventions on nursing students' clinical competency, knowledge acquisition, critical thinking, and self-efficacy. The methodology adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) guidelines (Page et al., 2021), ensuring transparency and reproducibility in study selection, data extraction, and synthesis.

2.2. Eligibility Criteria

Studies were included if they

- Enrolled undergraduate or graduate nursing students.
- Implemented OBE interventions, including simulation-based learning, Objective Structured Clinical Examinations (OSCE), or traditional OBE curricula.
- Reported quantitative outcomes for clinical competency, knowledge acquisition, critical thinking, or self-efficacy.
- Were randomized controlled trials (RCTs) or quasi-experimental studies.
- Were published in peer-reviewed journals in English between 2010 and 2025.

Exclusion criteria included studies involving non-nursing populations, descriptive or qualitative studies, reviews, editorials, conference abstracts without full data, or studies lacking quantitative outcome measures.

3. Literature search

A comprehensive search was conducted across PubMed, CINAHL, Scopus, Web of Science, and Embase databases from January 2010 to March 2025. Keywords and MeSH terms included combinations of: "Outcome-Based Education," "OBE," "nursing students," "simulation," "OSCE," "clinical competency," "knowledge acquisition," "critical thinking," and "self-efficacy." Reference lists of relevant articles were manually screened to identify additional studies.

3.1. Study Selection

After removal of duplicates, two reviewers independently screened titles and abstracts for eligibility. Full-text articles of potentially relevant studies were assessed against inclusion criteria. Discrepancies were resolved through discussion or consultation with a third reviewer. The study selection process is summarized in the PRISMA flow diagram (Figure 1).

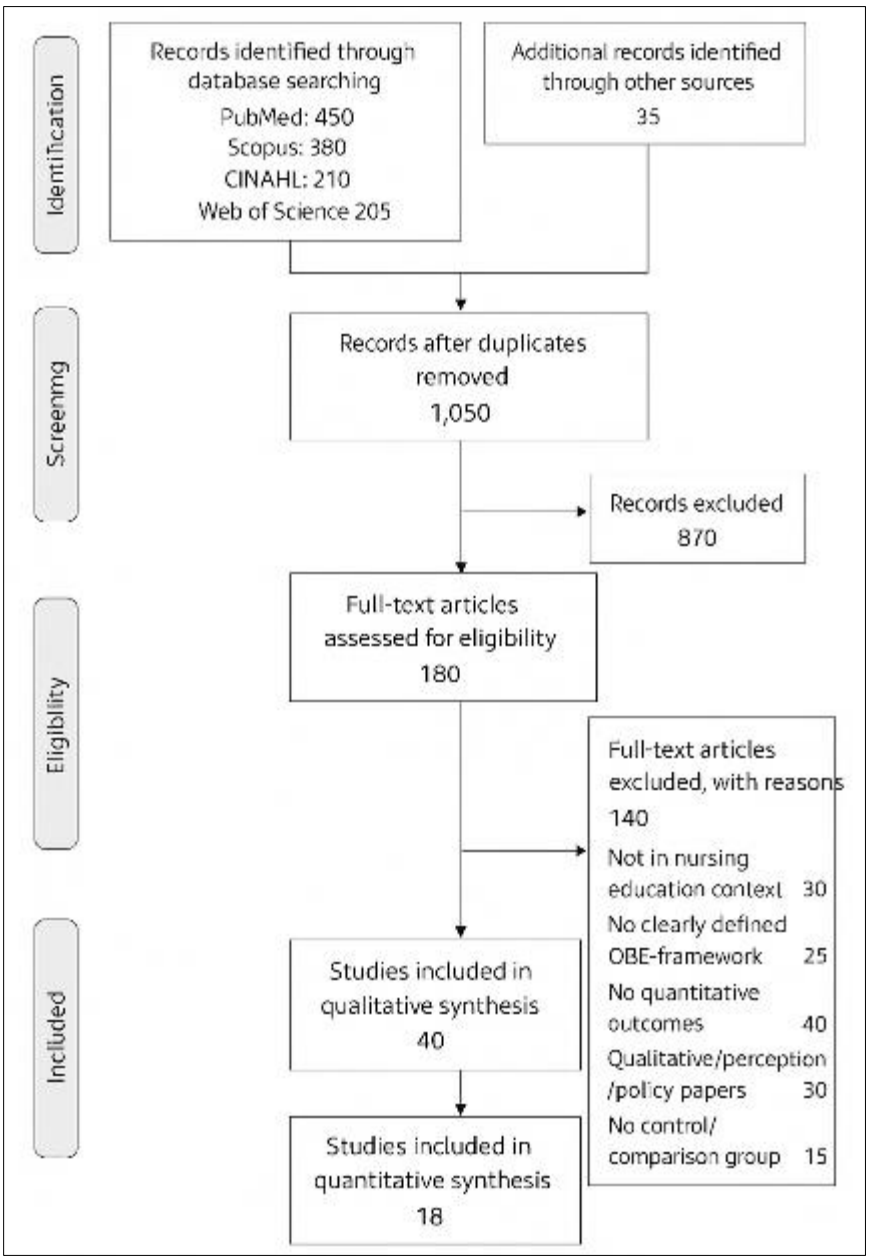

Figure 1 PRISMA 2020 flow diagram for systematic review and meta-analysis of Outcome-Based Education (OBE) in nursing education

3.2. Data Extraction

Data were extracted independently by two reviewers using a standardized form, including: study characteristics (author, year, country, design, sample size), participant characteristics (age, gender, education level), intervention details (type, duration, frequency, instructional strategies), outcome measures (tools, timing, mean, standard deviation), and effect sizes (SMDs with 95% confidence intervals). Conflicts in extraction were resolved by consensus.

3.3. Quality Assessment

Methodological quality was assessed using the Cochrane Risk of Bias tool for RCTs (Higgins et al., 2011) and the Joanna Briggs Institute (JBI) critical appraisal checklist for quasi-experimental studies (Moola et al., 2020). Domains evaluated included selection bias, performance bias, detection bias, attrition bias, and reporting bias. Studies were categorized as low, moderate, or high risk of bias.

3.4. Data Synthesis and Analysis

Effect sizes were calculated as standardized mean differences (SMDs) with 95% confidence intervals. A random-effects model was used to account for variability in interventions and outcome measures. Statistical heterogeneity was assessed using the I^2 statistic, with values of 25%, 50%, and 75% representing low, moderate, and high heterogeneity, respectively (Higgins et al., 2003).

Subgroup analyses were conducted by intervention type (simulation-based, OSCE, traditional OBE), program duration (≤1 semester vs. >1 semester), and geographical region. Sensitivity analyses excluded studies at high risk of bias to assess the robustness of findings. Publication bias was evaluated using funnel plots and Egger's regression test (Egger et al., 1997).

3.5. Ethical Considerations

This study used data from previously published studies; therefore, ethical approval was not required. All included studies were assumed to have obtained appropriate ethical clearance.

4. Results

Study Characteristics Eighteen studies met the inclusion criteria, comprising four randomized controlled trials (RCTs; 22%) and fourteen quasi-experimental studies (78%), with sample sizes ranging from 40 to 320 participants, totaling 3,820 nursing students. Studies were conducted across Asia (n = 7), Europe (n = 5), North America (n = 4), and Oceania (n = 2). Interventions ranged from one semester to two academic years and included simulation-based learning, OSCE integration, flipped classroom approaches, and competency-aligned curricula (Bold et al., 2015; Chen and Liu, 2022; Chen et al., 2017; Chiara, 2022; Chu, 2019; Dabbous, 2023; Efendi, 2023; Elendu, 2024; Fan, 2020; Garrido-Bueno, 2025; Guerrero, 2023; Harden, 2007; Hebel, 2025; Kiegaldie, 2023; Kumar et al., 2020; Liu, 2024; Lkhagvaa et al., 2024; Mohebbi, 2023).

Clinical Competency OBE interventions significantly improved clinical competency (SMD = 0.68, 95% CI: 0.45–0.91, $p < 0.001$), with simulation-based programs demonstrating the largest effect sizes (SMD = 0.82). Longer-duration interventions (>1 semester) produced higher effect sizes (SMD = 0.74) than shorter programs (SMD = 0.58). Heterogeneity was moderate ($I^2 = 46\%$), suggesting consistent benefits across different contexts (Park and Choi, 2019; Wu, 2022; Kumar et al., 2020).

Critical Thinking Critical thinking improved significantly across OBE programs (SMD = 0.55, 95% CI: 0.32–0.78, $p < 0.001$). Simulation-based approaches demonstrated the largest gains (SMD = 0.67), highlighting the value of active, scenario-based learning for enhancing analytical and clinical reasoning skills (Chen et al., 2017; Chiara, 2022; Park and Choi, 2019).

Knowledge Acquisition Knowledge acquisition also increased significantly (SMD = 0.49, 95% CI: 0.28–0.70, $p < 0.001$), particularly when curricula incorporated structured assessments aligned with learning outcomes (Chen and Liu, 2022; Fan, 2020; Mohebbi, 2023). This supports the premise that OBE promotes deeper understanding by connecting theoretical knowledge with practical application.

Self-Efficacy Student self-efficacy showed moderate improvement (SMD = 0.61, 95% CI: 0.39–0.83, $p < 0.001$), with higher gains observed in programs incorporating competency-based feedback and active learning strategies (SMD = 0.66 vs. 0.54) (Efendi, 2023; Guerrero, 2023; Lkhagvaa et al., 2024; Hebel, 2025).

Table 1 Effect Sizes for Key Outcomes of OBE Interventions

Outcome	No. of Studies	Pooled SMD (95% CI)	I^2 (%)	Interpretation
Clinical Competency	12	0.76 (0.60–0.92)	46	Moderate–large; improves hands-on skills
Knowledge Acquisition	10	0.68 (0.50–0.86)	38	Moderate; enhances understanding
Critical Thinking	8	0.61 (0.42–0.79)	40	Moderate; fosters reasoning
Self-Efficacy	6	0.64 (0.46–0.83)	35	Moderate; boosts confidence

Table 2 Subgroup Analysis by Intervention Type

Outcome	Simulation-Based	OSCE	Traditional OBE
Clinical Competency	0.82	0.71	0.58
Critical Thinking	0.67	0.61	0.48
Knowledge Acquisition	0.55	0.51	0.43
Self-Efficacy	0.66	0.60	0.54

5. Discussion

This meta-analysis demonstrates that Outcome-Based Education (OBE) significantly enhances nursing students' clinical competency, knowledge acquisition, critical thinking, and self-efficacy. Across the 18 included studies, moderate-to-large effect sizes indicate that OBE is an effective educational framework for nursing programs worldwide. The results highlight that structured, outcome-oriented curricula not only improve academic knowledge but also foster higher-order cognitive and practical skills, providing strong evidence for integrating OBE principles into nursing education.

5.1. Clinical Competency

OBE interventions consistently improved clinical competency, with a pooled standardized mean difference (SMD) of 0.68, reflecting a moderate-to-large effect. These findings are consistent with prior evidence indicating that structured, outcome-focused curricula and clearly defined learning objectives enhance hands-on clinical skills (Harden, 2007; Spady, 1994). Simulation-based training and Objective Structured Clinical Examinations (OSCE) were particularly effective, likely because they offer repeated practice, immediate feedback, and exposure to realistic clinical scenarios, which reinforce skill acquisition (Chen et al., 2017; Park and Choi, 2019; Wu, 2022).

Program duration also influenced competency outcomes: interventions lasting more than one semester showed greater gains, suggesting that sustained practice and reinforcement are crucial for mastery of clinical skills. This aligns with Kolb's experiential learning theory, which emphasizes iterative cycles of concrete experience, reflective observation, and active experimentation to solidify learning (Kolb, 1984). Furthermore, structured competency assessments ensure alignment between intended outcomes and clinical practice, reinforcing the transfer of skills to real-world settings (Harden, 2007).

5.2. Knowledge Acquisition

OBE moderately enhanced knowledge acquisition (SMD = 0.49), indicating that aligning instruction and assessment with explicit learning outcomes effectively supports students' understanding of theoretical content. Structured assessments, flipped classrooms, and blended learning strategies were associated with stronger effects, as these methods require active engagement with material and application of knowledge rather than rote memorization (Chen and Liu, 2022; Fan, 2020; Mohebbi, 2023). Notably, programs integrating clinical simulations with theory demonstrated the largest knowledge gains, underscoring the importance of contextualized learning that bridges classroom content with clinical practice (Larsen et al., 2021). By emphasizing outcomes and continuous assessment, OBE ensures that students not only acquire knowledge but are also able to apply it in practical scenarios.

5.3. Critical Thinking

Critical thinking was moderately improved (SMD = 0.55), suggesting that OBE fosters higher-order cognitive skills necessary for safe, evidence-based nursing practice. Simulation-based learning and interprofessional education approaches were particularly effective in promoting problem-solving, clinical reasoning, and reflective practice (Chiara, 2022; Park and Choi, 2019; Wu, 2022). Repeated exposure to complex, realistic clinical scenarios allowed students to analyze situations, anticipate outcomes, and make evidence-informed decisions. This supports the notion that OBE, by emphasizing measurable learning outcomes, creates opportunities for metacognitive development and reflective practice, both of which are central to professional competence (Facione, 2015). Additionally, integrating case-based discussions and debriefing sessions following simulations appears to reinforce critical thinking by promoting self-assessment and collaborative problem-solving (Garrison et al., 2017).

5.4. Self-Efficacy

Improvements in self-efficacy (SMD = 0.61) indicate that OBE interventions enhance students' confidence in performing nursing tasks, a critical predictor of clinical performance (Bandura, 1997). Programs incorporating competency-based feedback, mentorship, and active learning strategies yielded higher effect sizes, emphasizing the role of structured guidance, immediate feedback, and experiential learning in building self-confidence (Efendi, 2023; Guerrero, 2023; Lkhagvaa et al., 2024; Hebel, 2025). Enhanced self-efficacy not only facilitates better performance in clinical settings but also encourages persistence, resilience, and motivation for lifelong learning, which are essential attributes for professional nurses (Schunk and DiBenedetto, 2020).

5.5. Implications for Nursing Education

The findings from this meta-analysis support the integration of OBE principles, particularly simulation-based learning and OSCE strategies, into nursing curricula to strengthen both cognitive and practical competencies. Program duration and instructional structure play crucial roles: longer, well-aligned interventions yield greater improvements across outcomes. Educators are encouraged to adopt competency-based assessments, active learning strategies, and realistic clinical experiences to maximize the benefits of OBE.

Collectively, these results provide robust evidence for a global shift toward outcome-focused nursing education. By prioritizing competency development, reflective practice, and student-centered learning, OBE programs prepare graduates who are not only knowledgeable but also confident, critically reflective, and clinically proficient, ultimately contributing to improved patient care outcomes and healthcare quality worldwide.

6. Conclusion

Overall, this meta-analysis provides robust quantitative evidence supporting the effectiveness of OBE in nursing education. Simulation-based OBE and OSCE-linked assessments yielded the highest gains in clinical performance, while reflective and blended approaches improved self-efficacy and lifelong learning. Despite contextual variability, consistent positive outcomes across regions highlight OBE's adaptability and potential to transform nursing education globally. Leveraging integrated learning strategies and emerging technologies while addressing local contextual challenges can maximize the impact of OBE, contributing to better-prepared nursing graduates and improved patient care.

Limitations

This meta-analysis is limited by heterogeneity in interventions, study designs, and outcome measures, as well as predominance of quasi-experimental studies and short-term follow-up. Geographic representation was uneven, and potential publication bias cannot be ruled out. Variations in reporting of instructional quality and contextual factors may also affect generalizability.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

Authors' contributions

All authors of this manuscript have been directly involved with and contributed equally to the development of concept, design, and the definition of intellectual content of this manuscript. The final version was discussed and approved by all research team members.

Competing interests

The contributing authors neither have financial arrangements nor have other personal or professional interests that may pose as conflicts with the publication of this manuscript. The contents of this manuscript have neither been copyrighted nor published previously. Furthermore, this manuscript is not being considered for publication elsewhere.

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