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Effects of Interactive Digital Learning on Nursing Knowledge, Self-Efficacy, and Educational Outcomes: A Systematic Review and Meta-Analysis

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ADMINISTRATIVE INFORMATION

Support - None.

Review Stage at time of this submission - The review has not yet started.

Conflicts of interest - None declared.

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Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 29 April 2026 and was last updated on 29 April 2026.

INTRODUCTION

Review question / Objective The specific objectives are to: (1) quantitatively evaluate the effects of interactive digital learning interventions on key educational outcomes (e.g., knowledge, self-efficacy, and motivation) compared to conventional methods; (2) assess methodological quality and evidence certainty using the Cochrane Risk of Bias 2 tool; and (3) identify implications for the future design of digital nursing education.

Condition being studied Nursing students or Nurses.

METHODS

Participant or population Nursing students or Nurses.

Intervention eBooks (e-books) designed for educational purposes.

Comparator Conventional educational approaches, static materials (e.g., paper handouts, plain-text PDFs, pre-recorded videos), or standard curriculum without additional interactive interventions.

Study designs to be included RCTs or cluster-randomized controlled trials.

Eligibility criteria Inclusion Criteria:
Population (P): Pre-registration nursing students or registered nurses (RNs).
Intervention (I): Interactive digital learning interventions (e.g., interactive eBooks) that incorporate features for active learner engagement (e.g., embedded quizzes, branching scenarios, or adaptive content).
Comparator (C): Conventional educational approaches or standard curriculum without the use of interactive digital tools (e.g., face-to-face lectures, paper handouts, or static PDFs).
Outcomes (O): Studies reporting sufficient quantitative data (means, standard deviations, and sample sizes) for at least one prespecified

outcome (e.g., knowledge, learning motivation, self-efficacy, or skill-related outcomes) assessed via validated instruments.
Study design (S): Randomized controlled trials (RCTs) or cluster-RCTs.
Exclusion Criteria:
1. They enrolled non-nursing populations.
2. The intervention did not contain interactive digital components or merely consisted of digitized static content.
3. Outcome data were reported in a format that precluded extraction or imputation of continuous-variable summary statistics.
4. the full text was unavailable in English, Traditional Chinese.

Information sources PubMed, MEDLINE, EMBASE, CINAHL, Cochrane Library, Web of Science, Airiti Library and the Korea Citation Index. Date: up to April 2026.

Main outcome(s) Primary outcome: Knowledge.
Secondary outcomes: Self-confidence, learning motivation, self-efficacy, problem-solving ability, prevention strategies, coping behaviour, and learner satisfaction.

Quality assessment / Risk of bias analysis Cochrane Risk of Bias 2 (RoB 2) tool for randomized trials. For cluster-randomized trials, the RoB 2 extension for cluster-randomized designs was applied.

Strategy of data synthesis Quantitative data synthesis and statistical analyses will be conducted using RevMan Web. All continuous outcomes will be pooled using standardized mean differences (SMDs) with 95% confidence intervals (CIs). A random-effects model will be applied by default to account for expected methodological and clinical heterogeneity across different interactive eBook designs. Between-study heterogeneity will be assessed using the I^2 statistic, with thresholds of 25%, 50%, and 75% representing low, moderate, and high heterogeneity, respectively. If quantitative synthesis is not feasible, a narrative synthesis will be performed.

Subgroup analysis Where sufficient data are available (e.g., at least two studies per subgroup), prespecified subgroup analyses will be conducted to explore potential sources of heterogeneity. The planned subgroups include: (1) participant type (nursing students vs. registered nurses), and (2) intervention duration (short-term vs. long-term exposure to the interactive eBooks).For the primary outcome (e.g., knowledge), a prespecified subgroup analysis will be conducted based on participant type (registered nurses vs. nursing students) to explore potential sources of heterogeneity.

Sensitivity analysis This will be achieved primarily by employing the leave-one-out method, which involves sequentially omitting one study at a time to examine whether the overall effect estimate is disproportionately influenced by any single study. Additionally, studies assessed as having a high risk of bias will be excluded to verify the stability of the primary results.

Country(ies) involved Taiwan.

Keywords digital learning; interactive eBook; meta-analysis; nursing education; self-efficacy; simulation; systematic review.

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