An integrative review of computer-based simulation in the education process

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Authors' objectives
To determine the effect of computer-based simulation on health-care education and learning.

Searching
MEDLINE, CINAHL, EMBASE, HealthSTAR, an aerospace database and ERIC were searched for potential studies for inclusion in the review; the search terms were provided, but the search dates were not. The reference lists of all retrieved articles were reviewed for additional sources.

Study selection
Study designs of evaluations included in the review
The author did not state any specific inclusion criteria in relation to the study design. All of the studies used a pre-test post-test design, three with a comparison or control group; one study also used a crossover design.

Specific interventions included in the review
Studies that included some type of computer-based simulation were eligible for inclusion. The specific interventions assessed were: the use of a cardiologic patient simulator, computer simulation of a cardiovascular arrest situation, a cardiovascular patient simulator, heart sound simulation, anaesthesia Gas Man simulation, and a structural clinical examination simulation.

Participants included in the review
Studies had to report the disciplines of the researchers, as well as those of the study participants, in order to be eligible for inclusion. The included studies were conducted in medical schools with medical students or residents. The remaining studies were conducted by registered nurses, using nurses as the participants.

Outcomes assessed in the review
Studies had to include an outcome measure related to education, which included the mean score and standard deviation, in order to be eligible for inclusion. In all of the included studies, the outcome measure was an examination or practical skills test score.

How were decisions on the relevance of primary studies made?
The author did not state how the papers were selected for the review, or how many reviewers performed the selection.

Assessment of study quality
The author did not state that they assessed validity.

Data extraction
The author did not state how the data were extracted for the review, or how many reviewers performed the data extraction. The effect size for each outcome measure was calculated for each of the studies.

Methods of synthesis
How were the studies combined?
The author used a narrative synthesis to discuss the overall direction of effect of the results of the studies.

How were differences between studies investigated?
The author did not attempt to examine any differences between the studies.
**Results of the review**
Nine pre-test post-test studies (n=779) were included, three of which used a comparison or control group (n=352).

Sixteen effect sizes or d indexes were calculated. The effect sizes that favoured simulation accounted for 75% of the d indexes and ranged from 0.34 to 5.06. The effect sizes in one study (12.5%) did not support simulation. The remaining 12.5% of the effect sizes were fairly neutral, ranging from 0.14 to 0.26.

**Authors' conclusions**
The results of the review indicate that 75% of the studies showed positive effects of simulation on skill and/or knowledge acquisition.

**CRD commentary**
The review question was clearly defined in terms of the interventions, outcomes and participants. A number of sources were searched for relevant studies, but no efforts were made to reduce language or publication bias. The methods used to select the studies for inclusion in the review were not described, so it is not known whether any processes where instigated to reduce errors. Likewise, there was no description of the methods used to assess the quality of the included studies, or to extract the data. The data were tabulated in full and presented along with a narrative discussion of the study results. Overall, it is not entirely clear how this review was conducted, or what the strength and quality of the evidence base reviewed was. Therefore, the author's conclusions should be considered preliminary until further research is conducted.

**Implications of the review for practice and research**
Practice: The author did not state any implications for practice.

Research: The author stated that further research is needed to investigate the best ways to use simulation in the health-care environment, and to assess the effectiveness of this education strategy for basic nursing education as well as in the continuing education of nurses.

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Record Status
This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.