The effectiveness of Immersive Educational Technologies compared to Non-Immersive ones on Clinical Skills among Nursing & Midwifery Students during COVID-19: A Protocol for a Systematic Review

Nahid zarifsanaiey
Shiraz University of Medical Sciences
Zahra Karimian
Shiraz University of Medical Sciences
Nilofar Barahmand
Shiraz University of Medical Sciences
Manoosh Mehrabi (mehrabi.manoosh@gmail.com)
Shiraz University of Medical Sciences https://orcid.org/0000-0002-2024-9415
Ali Reza Safarpour
Shiraz University of Medical Sciences

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Abstract

Background

Learning clinical skills is one of the most important responsibilities of medical students, especially midwives and nurses. The outbreak of COVID-19 pandemic has created a challenge in teaching clinical skills and at the same time movement towards online training such as using immersive educational technologies (IET). The primary objective of this study is to determine whether IET compared to non-IET are effective in clinical skills among nursing and midwifery students during COVID-19.

Methods

Health professions including nursing & midwifery students are populations of this study. We will include randomized clinical trials or controlled trials that investigate the effectiveness of immersive educational technologies on clinical skills among nursing and midwifery students during COVID-19. Traditional clinical education learning methods, face to face (didactic) learning, classroom learning, in-person clinical instruction, in-person clinical attachments, multimedia, games, e-books and so on are comparators. The primary outcome of this study is measuring clinical skill performance among Nursing & midwifery students and comparing the efficacy of immersive educational technologies (IET) and non-immersive ones during covid-19. Clinical skills should have been measured objectively with clinical examination, or a reliable and valid checklist for measuring clinical skills or clinical competence. Randomized clinical trials or controlled trials will be eligible to include in the review.

Discussion

Given the increasing growth of immersive educational technologies, the information gathered from this study can be used by health decision makers to pay attention to educational methods based on their effectiveness and efficiency, especially in the time of crisis.

Systematic Review Registration:

PROSPERO Registration Number is, CRD42022369713 in 01.11.2022

Background

One of the most important strategies for preparing students to enter the clinical environment, accept responsibility, and improve their ability to make health decisions is clinical education (1). Studies have shown that medical students, especially midwives and nurses, as the front line of treatment, face some difficulty in learning clinical skills to reach a level of competence and safe performance in clinical environments (2, 3, 4, 5). In the past few years, the outbreak of the COVID-19 pandemic has created a

challenge in teaching clinical skills to medical students due to the possibility of increasing the spread of the disease (6). At this time, due to the closure of educational environments and the creation of social distancing, there was a movement towards online training, but there was a question about whether clinical skills could be taught online (7). There is evidence that students can learn clinical skills through online resources. But how effective this learning is, is unknown. However, the use of these technologies in teaching clinical skills continues (8). Because educational technologies have changed the way we learn. Educational technologies such as virtual reality augmented reality, and mixed reality, which are collectively called immersive technologies, are actually software designed based on effective educational methods. These educational technologies (IET) are designed based on the theory of constructivism and experiential learning and create an environment where the learner learns while doing the activity, his creativity increases, and he gets a deeper understanding of the concepts (9). Immersive technologies compared to non-immersive educational technologies (NIET) create the feeling of being in a three-dimensional environment compared to conventional two-dimensional environments (10, 11). The Cochrane databases (CDSR), Scopus, PROSPERO and Pubmed were searched to find past systematic reviews and ongoing protocols. A systematic review conducted in 2022 by Ryan et al. showed that immersive technology did not change the knowledge gained by medical and nursing students compared to conventional methods, but enriched their learning experience (9). Also, a systematic review protocol was found by McNamara et al. in the Prospero system that questioned how immersive technology has been used to teach clinical skills in medical education. And how have these abilities been assessed and their effectiveness quantified (12)? Another systematic review reported in 2021 by Bartit et al. found that the use of these immersive, salient, motivating, and engaging technologies was effective in most cases, but few studies reported that no difference in effectiveness had been seen (13). The present study seeks to find an answer to the question of whether there is a difference between immersive and non-immersive educational methods in terms of change (increase/decrease) in the clinical skills of nurses and midwives when they are used during the pandemic. Also, have the differences in sex, age,... been effective in these changes? According to the studies, no comprehensive study that can answer our research question has been conducted thus far. The present systematic review will evaluate the global impact of the use of immersive technologies compared to other technology-based methods in the COVID-19 era, on the clinical skills of nurses and midwives. Since technologies are continuously improving, it is necessary to regularly evaluate their effectiveness in different areas.

Aim and objectives

Primary objective

To determine whether IET compared to NIET are effective in clinical skills among nursing and midwifery students during COVID-19.

Secondary objectives

- To compare two methods of education, taking into account the effect of age groups, gender, study semester, the field of study (nursing, midwifery), level of education (bachelor's, master's, doctorate), and employment at the same time.
- To compare two training methods considering the effect of the type of clinical skills presented.
- To compare two teaching methods considering the influence of the geographical area. To compare two methods of education considering the impact of the university level.

Review question

The systematic review study has been guided by the following research question:

'What has been the impact of IET as compared to NIET on clinical skills among nursing & midwifery students during COVID-19?

PICOT

Population: Health professions including nursing & midwifery students.

Intervention: We will include randomized clinical trials or controlled trials that investigate the effectiveness of immersive educational technologies on clinical skills among nursing and midwifery students during COVID-19.

Comparisons: Traditional clinical education learning methods, face to face (didactic) learning, classroom learning, in-person clinical instruction, in-person clinical attachments, multimedia, games, e-books and so on.

Outcome: The primary outcome of this study is measuring clinical skill performance among Nursing & midwifery students and comparing the efficacy of immersive educational technologies (IET) and non-immersive educational technologies during covid-19. Clinical skills should have been measured objectively with clinical examination, or a reliable and validated checklist for measuring clinical skills or clinical competence.

Type of the studies: Randomized clinical trials or controlled trials will be eligible to include in the review.

Condition or domain being studied

The condition which is being study in this systematic review is Clinical education.

Immersive clinical educational technologies (IET) are included:

Clinical educational technologies such as virtual reality, augmented reality, and mixed reality, which are collectively called immersive technologies, are actually software designed based on effective educational methods. These technologies are designed based on the theory of constructivism and experiential

learning and create an environment where the learner learns while doing the activity and his/her creativity increases and he/she gets a deeper understanding of the concepts (9).

Non-immersive clinical educational technologies (NIET) are included:

Other clinical educational technologies will include into the non-immersive category, including Traditional clinical education learning methods, face to face (didactic) learning, classroom learning, in-person clinical instruction, in-person clinical attachments, multimedia, games, e-books and so on.

Methods/designs

This protocol has been created in accordance with the recommendation from the Cochrane Collaboration (14). The Preferred Reporting Items for Systematic Reviews and Meta-Analysis Protocols (PRISMA-P) checklist has been utilized in the planning of this protocol (15).

Inclusion and exclusion criteria

Types of participant

Studies in which nurses, midwives, and nursing and midwifery students participated in all bachelor, master and doctoral degrees will be included in the present study. Studies that included a combination of medical group participants, including nurses or midwives, will not include in the study.

Types of interventions:

We will include randomized clinical trials or controlled trials that investigate the effectiveness of IET on Clinical Skills among Nursing & Midwifery students.

Types of Comparators:

IET could be compared to all types of NIET including multimedia, games, e-books and so on.

Settings

This review will include all settings including hospitals, private clinics, and university settings.

There will be no restrictions on age, sex, study department or group, university, geographic region, race or specific culture and time of using this technology, in this study.

Main Outcome

The primary outcome of this study is measuring clinical skill performance among Nursing & midwifery students during covid-19. Clinical skills should have been measured objectively with clinical examination, or a reliable and validated checklist for measuring clinical skills or clinical competence. Clinical skills education especially in midwives and nurses, as the front line professions in the treatment of patients, is one of the most important strategies to prepare students to enter the clinical environment and accept

responsibility and improve their ability to make health decisions. Examining the effectiveness of new educational methods in teaching clinical skills methods and comparing these methods with traditional ones, can take an important step in using more effective methods. The results will lead to improved clinical decision-making and treatment methods in patients' care.

Measures of effect

Measures of effect for continuous outcomes will be mean differences and standardized mean differences.

Additional Outcomes

- To compare two methods of education, taking into account the effect of age groups, gender, study semester, the field of study (nursing, midwifery), level of education (bachelor's, master's, doctorate), and employment at the same time.

- To compare two training methods considering the effect of the type of clinical skills presented.

- To compare two teaching methods considering the influence of the geographical area.

- To compare two methods of education considering the impact of the university level.

The outcome assessment tools include

All standardized, validated, and reliable “clinical skills rating scales” suitable for nurses and midwiferies will be included in our review.

Exclusion criteria

We will exclude the following study types: Observational studies (i.e. cross-sectional studies, cohort studies), case reports, comments, letters to the editor, daily reports, books, summaries without full text and animal studies. We will use narrative reviews, systematic reviews, and meta-analyses to check the references for our review.

Search strategy

In order to conduct the most comprehensive search, all available sources including published and unpublished studies will be reviewed. Related databases such as Scopus, Pubmed, Clarivate Analytics, ASSIA, CINAHL, EMBASE, Education Research, Medline, BEI, BNI and Eric, Google Scholar search engine, intervention registration systems such as “All Trials” and RIAT, and grey literature will be reviewed. Furthermore, there will be no language restriction for including studies. The full syntax of the PubMed database is shown in the link below. To produce this syntax, keywords from MeSH, Emtree and ERIC thesaurus banks have been utilized. Components are Immersive Educational Technologies (AR, VR, MR and simulation) AND nurses and midwives.

https://www.crd.york.ac.uk/PROSPEROFILES/369713_STRATEGY_20221023.pdf

Procedure for study selection

Three independent reviewers will initially screen titles and abstracts to identify eligible studies based on the inclusion and exclusion criteria. After the elimination of clearly ineligible studies, the full texts of the remaining studies will be reviewed to ensure eligibility. Discrepancies between the reviewers will be resolved by discussion and consultation with a fourth reviewer.

We will collect all retrieved studies in Endnote software from all databases. Removal of duplicate records

Data extraction

The data extraction table will be developed according to the recommendations from PRISMA and will be refined after the pilot- testing of four studies. Data will be extracted from the full text of the articles. Two reviewers, independently, will be extracted data from all included studies. Discussions and consultations with a third reviewer will resolve discrepancies between the two reviewers.

The following information will be extracted from each study: first author's name, year of publication, study country and location, design of the study, participants' characteristics, study duration, sample size, study's quality, type of comparison arm, measurement tools for evaluation of outcome(s) of the studies, and mean (SD) and SE of score in both groups in the studies.

If the eligible studies report incomplete statistical data, we will calculate the missing data or email the study authors in this regard. The article will be excluded if the study authors do not respond to queries for three times.

Risk of bias assessment

The risk of bias assessment of the included studies will be performed using the Cochrane Collaboration tool by two independent reviewers (14). Any discordance between reviewers will be resolved through consensus or the third expert's opinion. The Cochrane tool considers random sequence generation, allocation concealment, insufficient outcome data, blinding of personnel and participants, blinding of outcome assessors, selective outcome reporting, and other sources of biases. Finally, the overall risk of bias for each study will be judged as "high", "low" or "unclear".

Statistical analysis

Pooled Analysis

The pooled standardized mean difference will be calculated if methodological heterogeneity of all final included studies will not considerable. The combination method will be based on methodological similarities in the included studies by the Fixed Effect Model or the Random Effect Model. Forest plots will be plotted for all the studies to show the separated and pooled effect size and their corresponding 95% CIs. Stata V.14.1 (StataCorp, USA) will be used for the statistical analysis in the current study. If the

methodological heterogeneity of include studies will be considerable, we will not combined and narrative qualitative report will be performed.

Assessment of heterogeneity

Statistical heterogeneity of the results will be evaluated by the I^2 statistic, Q-statistic test, and the corresponding 95% confidence intervals. The I^2 statistic of 0–40%, 30–60%, 50–90%, and 75–100% will be judged as ‘perhaps not important’, ‘moderate heterogeneity’, ‘substantial heterogeneity’, and ‘considerable heterogeneity’, respectively. $P < 0.05$ will be considered significant for the Q-statistic test (14).

Subgroup analysis

For assessing of the sources of statistical heterogeneity, subgroup analysis according to the age and gender of the participants, academic semester, the field of study (nursing, midwifery), level of education (bachelor's, master's, doctorate), concurrent employment at the same time, geographical region (continents), and type of clinical skills will be performed.

Sensitivity analysis

A sensitivity analysis will be done for assessing methodological quality, data analysis considerations, limitations of the study design, and the effect of missing data. This sensitivity analysis will be according to the one-out remove method. In this method, the other papers will be combined, and they will be compared with each other with one of the papers excluded each time.

Quality analysis

The association between the methodological quality of the eligible studies and their outcomes will also be examined. When there are significant variances between the outcomes of high-quality and poor-quality studies, a combination of articles with a minimum acceptable methodological quality shall be considered as an accurate estimation of the combination of these eligible studies.

Assessment of publication biases

Publication bias arises when the probability of research publication is influenced by the direction of the findings. This bias is one possible cause of 'small-study effects' that is a trend for smaller trials to show more beneficial effect of an intervention. We will assess publication bias using funnel plot if meta-analysis comprises ten or more studies. Funnel plot allows a visual assessment of whether small-study effects may be present in a meta-analysis.

We will use GRADE (grading of recommendation, assessment, development and evaluation) tool to assess the certainty of the evidence.

Discussion

This systematic review and meta-analysis study will show the effectiveness of immersive educational technologies compare to non-immersive ones. The use of these technologies (IET) during COVID-19 pandemic will shoe their appropriateness use in the crisis time. Given the increasing growth of immersive educational technologies, the information gathered from this study can be used by health decision makers to pay attention to educational methods based on their effectiveness and efficiency, especially in the time of crisis.

Abbreviations

IET: Immersive Educational Technologies

NIET: Non Immersive Educational Technologies

Declarations

Ethics approval and consent to participate

Not Applicable.

Consent for publication

Not Applicable.

Availability of data and materials

Not Applicable.

Competing interests

The authors declare that they have no competing interests

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Authors' contributions

Conception and design of the work (NZ, ZKK, NB, MM, ARS), Draft & Revision (NZ, ZKK, NB, MM, ARS), Build syntax (MM, ARS), Search (MM, ARS). All authors read and approved the final manuscript.

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- PRISMAPchecklist.docx