INPLASY

Using Virtual Reality for Teacher Education: A Systematic Review and Meta-Analysis of the Literature from 2014 to 2024

Corresponding author:
Heng Luo

luoheng@mail.ccnu.edu.cn

Author Affiliation:
Central China Normal University.

Han, X; Luo, H; Zhang, DY; Wang, Z.

ADMINISTRATIVE INFORMATION

Support - Self.

Review Stage at time of this submission - Completed but not published.

Conflicts of interest - None declared.

INPLASY registration number: INPLASY202530118

Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 27 March 2025 and was last updated on 27 March 2025.

INTRODUCTION

Review question / Objective 1. What is the current status of global research on VR in teacher education? 2. What are the technological characteristics of VR applications for teacher education? 3. What are the main VR training objectives in teacher education? 4. What is the overall effectiveness of VR in teacher education and what factors moderate its effectiveness?

Condition being studied This protocol outlines a systematic review and meta-analysis of the use of virtual reality (VR) in teacher education. The review aims to synthesize existing evidence on how VR supports the development of teaching competencies, such as classroom management skills. The systematic review maps the scope and features of VR interventions in teacher education, while the meta-analysis quantifies their effectiveness based on experimental and quasi-experimental studies.

METHODS

Participant or population Pre-service teacher and In-service teacher.

Intervention The intervention under review is the use of virtual reality (VR) in teacher education. This includes immersive or semi-immersive VR systems —such as head-mounted displays (HMDs), desktop VR, or 360-degree videos—designed to support the development of teaching competencies (e.g., classroom management, pedagogical skills, metacognitive regulation, and content knowledge). The review includes both online and offline VR platforms, covering a variety of interactive learning environments such as simulation-based teaching practice, virtual microteaching, and immersive classroom scenarios.

Comparator The comparator includes teacher education interventions without the use of virtual reality (non-VR conditions), such as traditional

face-to-face instruction, video-based training, role-play, or other digital learning tools. These conditions serve as control groups to evaluate the added value of VR-based interventions in improving teacher-related outcomes.

Study designs to be included This study first followed the PRISMA guidelines to screen the literature, resulting in a total of 52 included studies. The research consists of two parts: the systematic review involved a descriptive analysis based on a coding framework, while the meta-analysis further selected experimental and quasi-experimental studies that compared VR-based teacher education interventions with non-VR conditions. Only studies that provided sufficient statistical data for effect size calculation were included in the meta-analysis.

Eligibility criteria Studies were eligible if they (1) focused on the use of virtual reality (VR) in teacher education; (2) were published in peer-reviewed journals between 2014 and 2024; (3) were written in English; and (4) involved pre-service or in-service teachers as participants. For the meta-analysis component, only experimental and quasi-experimental studies that (5) compared VR-based interventions with non-VR conditions, and (6) reported sufficient statistical data (e.g., means, standard deviations, sample sizes) to calculate effect sizes, were included. Studies were excluded if they were review articles, theoretical papers, conference abstracts, or lacked necessary outcome measures related to teacher development.

Information sources The following electronic databases will be systematically searched to identify relevant studies: Web of Science, Scopus. These databases cover a broad range of peer-reviewed journal articles, conference proceedings, and grey literature in the fields of education and educational technology. The search will be limited to publications from 2014 to 2024 to reflect the recent development of virtual reality in teacher education. In addition to database searching, backward and forward citation tracking will be conducted on included studies to identify additional relevant literature. Reference lists of key review articles will also be manually screened. No language restrictions will be applied during the initial search process, although only English-language full-text articles will be included in the final analysis. Where necessary, authors of primary studies will be contacted to obtain missing or unclear information to ensure the completeness of data extraction.

Main outcome(s) (1)The number of studies on VR in teacher education has shown an overall upward trend over the past decade, with nearly half not specifying the discipline or grade level taught by participants.
(2)Research predominantly targets pre-service teachers, with limited focus on in-service ones. Training duration varies, with short-term interventions (0-3 hours) being most common and long-term applications scarce.
(3)HMDs are the most used VR devices. Most research centers on highly immersive, interactive, non-portable, and internet-dependent VR systems. Oculus Rift, HTC Vive, and Quest are the most used VR brands, but costs were seldom described in the studies.
(4)Inquiry-based learning is the predominant teaching method. Training objectives mainly at classroom management skills and metacognitive skills.
(5)Meta-analysis shows VR has a moderate overall effectiveness (Hedges' g = 0.524) in teacher education. Level of immersion, VR equipment type, interactivity, and training objective are significant moderating factors.

Quality assessment / Risk of bias analysis The quality and risk of bias of the included studies were addressed through a structured screening and selection process based on the PRISMA 2020 guidelines. Inclusion and exclusion criteria were clearly defined to ensure relevance to teacher education and the application of virtual reality as an instructional tool. Incomplete or unclear studies were excluded or labeled accordingly during data coding and synthesis.

Strategy of data synthesis Both narrative and quantitative syntheses were conducted. Descriptive analysis was used to map publication trends, pedagogical strategies, and training outcomes etc. For quantitative synthesis, meta-analysis was performed using CMA 3.0 software. Hedges' g was selected as the effect size, and random-effects models were applied in the presence of heterogeneity. Moderator analysis and publication bias tests (funnel plot and fail-safe N) were also conducted.

Subgroup analysis To explore potential sources of heterogeneity, subgroup analyses will be conducted based on study-level moderators. These include research design (experimental vs. quasi-experimental), participant status (pre-service vs. in-service teachers), intervention duration, level of immersion (non-, semi-, fully immersive), type of VR equipment (e.g., HMD vs. computer), interactivity level, and training objectives (e.g.,

classroom management, pedagogical skills). The aim is to identify which conditions enhance the effectiveness of VR interventions in teacher education.

Sensitivity analysis Sensitivity analyses will be performed to test the robustness of the meta-analytic findings. Specifically, a leave-one-out method will be applied to assess whether the overall effect size is unduly influenced by any single study. In addition, extreme values will be examined to ensure that no outliers significantly bias the results. Studies with incomplete data or low methodological quality (if applicable) will be excluded in separate analyses to evaluate their impact on the overall conclusions.

Country(ies) involved China.

Keywords eacher education; teacher training; virtual reality; systematic literature review; meta-analysis.

Contributions of each author
Author 1 - Xue Han - Methodology, Formal analysis, Writing—original draft preparation, Visualization.
Author 2 - Heng Luo - Conceptualization, Methodology, Writing—review and editing, Supervision, Funding acquisition.
Author 3 - Dongyu Zhang - Formal analysis, Writing—original draft preparation, Visualization.
Author 4 - Zi Wang - Formal analysis, Writing—original draft preparation, Visualization.