

Review

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Video-mediated teaching for the development of competences in cardiopulmonary resuscitation by nursing undergraduates: a systematic review

Ensino vídeo-mediado no desenvolvimento de competência na ressuscitação cardiopulmonar por graduandos em Enfermagem: revisão sistemática

Enseñanza mediada por video en el desarrollo de competencias en reanimación cardiopulmonar por estudiantes de enfermería de pregrado: revisión sistemática

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ABSTRACT

Objective: To identify the effectiveness of videos as tools for developing clinical competence in cardiopulmonary resuscitation, comparing them with different teaching and learning strategies used in undergraduate nursing education.

Method: Systematic review conducted in the PubMed[®]/Medline[®], LILACS, Scopus, CINAHL, and Web of Science databases. Study selection and duplicate removal were performed using Rayyan[®], with methodological quality assessment conducted using the JBI and the Medical

Education Research Study Quality Instrument. Extracted data were analyzed using descriptive and comparative synthesis across the included studies.

Results: A total of 378 studies were identified, of which five composed the final sample. Most studies had good methodological quality. Videos were mainly compared with traditional teaching and clinical simulations. Effectiveness was measured using tests of knowledge, practical assessments using mannequins, and structured checklists. The results indicated comparable performance between methods, with statistically significant differences occasionally found in specific skills and participants' satisfaction levels.

Conclusion: Video-mediated teaching proved effective for the development of clinical competence in cardiopulmonary resuscitation, particularly in specific skills, with greater potential when integrated with other strategies. More methodologically robust research is needed, especially regarding attitudinal competencies.

Descriptors: Students; Nursing; Educational Technology; Clinical Competence; Cardiopulmonary Resuscitation; Learning.

RESUMO

Objetivo: Identificar a efetividade do vídeo como ferramenta para o desenvolvimento de competência clínica em ressuscitação cardiopulmonar, em comparação com diferentes estratégias de ensino e aprendizagem utilizadas na educação de graduandos em Enfermagem.

Método: Revisão sistemática desenvolvida nas bases PubMed®/Medline®, LILACS, Scopus, CINAHL e *Web of Science*. A seleção dos estudos e remoção de duplicatas foram realizadas no Rayyan®, com avaliação da qualidade metodológica pelo JBI e pelo *Medical Education Research Study Quality Instrument*. Os dados extraídos foram analisados por síntese descritiva e comparativa entre os estudos incluídos.

Resultados: Foram identificados 378 estudos, dos quais cinco compuseram a amostra final. A maioria apresentou boa qualidade metodológica. O vídeo foi comparado principalmente ao ensino tradicional e à simulação clínica. A efetividade foi mensurada por testes de conhecimento, avaliações práticas em manequins e *checklists* estruturados. Os resultados indicaram desempenho comparável entre os métodos, com diferenças estatisticamente significativas observadas de forma pontual em habilidades específicas e níveis de satisfação dos participantes.

Conclusão: O ensino mediado por vídeo mostrou-se efetivo para o desenvolvimento de competência clínica em ressuscitação cardiopulmonar, sobretudo em habilidades específicas, com potencial ampliado quando integrado a outras estratégias. São necessárias pesquisas metodologicamente mais robustas e voltadas à avaliação de competências atitudinais.

Descritores: Estudantes de Enfermagem; Tecnologia Educacional; Competência Clínica; Ressuscitação Cardiopulmonar; Aprendizagem.

RESUMEN

Objetivo: Identificar la efectividad del video como herramienta para el desarrollo de la competencia clínica en reanimación cardiopulmonar, en comparación con diferentes estrategias de enseñanza y aprendizaje utilizadas en la educación de estudiantes de enfermería de pregrado.

Método: Revisión sistemática desarrollada en las bases de datos PubMed®/Medline®, LILACS, Scopus, CINAHL y *Web of Science*. La selección de los estudios y la eliminación de duplicados se realizaron mediante Rayyan®, con evaluación de la calidad metodológica mediante el JBI y el *Medical Education Research Study Quality Instrument*. Los datos extraídos fueron analizados mediante síntesis descriptiva y comparativa entre los estudios incluidos.

Resultados: Se identificaron 378 estudios, de los cuales cinco conformaron la muestra final. La mayoría presentó buena calidad metodológica. El video fue comparado principalmente con la enseñanza tradicional y la simulación clínica. La efectividad se midió mediante pruebas de conocimiento, evaluaciones prácticas en maniqués y listas de verificación estructuradas. Los resultados indicaron un desempeño comparable entre los métodos, con diferencias estadísticamente significativas observadas de forma puntual en habilidades específicas y niveles de satisfacción de los participantes.

Conclusión: La enseñanza mediada por video se mostró efectiva para el desarrollo de la competencia clínica en reanimación cardiopulmonar, especialmente en habilidades específicas, con mayor potencial cuando se integra con otras estrategias. Se requieren investigaciones metodológicamente más robustas, especialmente orientadas a la evaluación de competencias actitudinales.

Descriptores: Estudiantes de Enfermería; Tecnología Educativa; Competencia Clínica; Reanimación Cardiopulmonar; Aprendizaje.

INTRODUCTION

The use of educational technologies in the education of health workers, by incorporating devices that encourage improvements in health standards, helps increase access to information, improve learning and teaching, promote the dissemination of knowledge, and support changes in practices of care⁽¹⁾.

In this context, videos have been a useful tool. They are complex, dynamic, and interesting for nursing teaching. When well-made, they can help build a solid base to support efficient reflection and understanding⁽¹⁾. This is supported by the fact that videos can overcome geographic and temporal barriers, easily reaching their target audience⁽²⁾. This characteristic helps teach and update the knowledge of nursing professionals and can have lasting impacts on the assistance provided.

From the perspective of educational psychology, the Cognitive Theory of Multimedia Learning suggests that multimodal resources, such as video, can be used to support learning, as they simultaneously activate multiple sensory channels, leading to a better assimilation and retention of knowledge⁽³⁾. This process is especially relevant in fields related to the development of practical abilities, such as health education.

From an educational perspective, the use of video has a relevant impact, as it allows standardizing the demonstration of procedures, can be repeated in accordance with the learner's rhythm, and helps self-directed learning⁽²⁰⁾. Furthermore, audiovisual resources facilitate visualizing critical stages of cardiopulmonary resuscitation (CPR), reducing variability in the instructions and increasing access to training, especially in settings where time, infrastructure, or the availability of instructors are limited⁽⁴⁾.

Thus, videos are a potentially effective tool for the development of clinical competencies, especially when integrated to other pedagogical strategies, such as clinical simulation⁽⁵⁾.

In the specific case of CPR teaching in nursing, educators still often use traditional approaches, be it because they are familiar with them or because they have resources available to do so. These strategies include expository classes with PowerPoint® presentations and the training of skills in a lab, under the orientation of an instructor, despite the fact that the use of clinical simulations in CPR is increasingly common⁽⁶⁻⁸⁾.

Evidence suggests that traditional CPR training methods have limited effectiveness in the quality of care, since cognitive and psychomotor abilities of participants already decrease in the first month after training is over. In this context, clinical simulations have been shown to be more effective in maintaining performance⁽⁹⁻¹⁰⁾. However, there is still no consensus in regard to the effectiveness of strategies mediated by videos in the development of the skills necessary for nursing students to provide CPR, as most of these strategies are aimed at professionals⁽¹¹⁻¹²⁾.

In the international setting, the rates of survival until hospital discharge after a cardiopulmonary arrest (CPA) outside of the hospital are around 10%. When in the hospital, survival rates vary from 19% to 40%, depending on the healthcare context and the characteristics of the population being served⁽¹³⁻¹⁵⁾.

Although the concept of clinical competence is broadly used in health education, its operational definition and the strategies used to measure it are not yet a consensus in literature⁽¹⁶⁻¹⁷⁾. The clinical competence of CPR includes the integration of theoretical knowledge, such as recognizing CPA; the order in which the care and recommended maneuvers should be done; psychomotor skills, related to the appropriate execution of compressions, ventilation, and device use; and professional attitudes, such as decision-making, communication, leadership, and teamwork^(5,9,16-17). Attitudinal competences, especially leadership and teamwork, have been increasingly valued when teaching CPR, due to their relevance in critical settings where time is of the essence⁽¹⁸⁾.

Studies have shown that, in clinical practice, the quality of CPR varies significantly, as shown by quantifiable metrics, such as the depth and rate of compressions, compression fractions, and lower number of interruptions⁽¹⁹⁻²⁰⁾.

An observational study carried out in real off-hospital CPR settings found that in only 46.1% of cases the recommended depth and rate of thoracic compression were reached. In 71.9% of cases, the fraction of thoracic compression was considered adequate ⁽²⁰⁾. These

findings suggest that, although specific parameters are often reached in a significant portion of cases, there is no consistency in reaching multiple quality indexes in CPR, showing how complex CPR is in clinical practice.

To evaluate the development of clinical competence is to jointly apply different skills in the different factors of practice. This includes knowledge, technical skills, and attitudes in different care contexts, and is considered to be a complex topic, difficult to put into practice⁽¹⁶⁾.

Many studies have explored this type of assessment when teaching CPR to nursing students, reaching variable results and evidence that is not always conclusive regarding the effectiveness of educational interventions^(6,11).

Considering the growing use of technological resources to disseminate health information, it is important to conduct an investigation that can evaluate the effectiveness of these tools in the teaching of CPR to nursing undergraduates. In this context, the selection and application of educational technologies and pedagogical strategies gain scientific support.

Thus, the objective of this study is to ascertain how effective videos are as tools for the development of CPR clinical competence, when compared to other educational strategies used to teach nursing students.

METHOD

This is a systematic literature review, conducted from February to May 2025, according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)⁽²¹⁾. The protocol of this review was registered in the Open Science Framework (OSF) platform, under DOI 10.17605/OSF.IO/8CTAJ.

The revision followed systematized stages, based on the methodological recommendations for systematic reviews, including: (1) formulation of the research question and delimitation of the target population and the intervention to be analyzed; (2) selection of databases and definition of descriptors, keywords, and search strategies; (3) definition of inclusion and exclusion criteria of the studies; (4) search in the databases conducted by two independent reviewers; (5) comparison of the results obtained by each reviewer and definition of the studies that are eligible for an early triage; (6) application of the eligibility criteria, including documents justifying potential exclusions and a critical analysis of the articles included; and (7) evidence summary^(21,22).

The research question was formulated following the PICO strategy (Patient, Intervention, Comparison, Outcomes), with the following components: the P were the nursing undergraduates; the I, the video; the C, the different educational strategies; and the O, the

development of clinical competence in CPR. Thus, the following guiding question was produced: How effective is a video as a tool for the development of CPR clinical competence, when compared to other educational strategies used to teach nursing students?

The search was conducted in PubMed[®]/MEDLINE[®], Latin American and Caribbean Health Sciences Literature (LILACS), Scopus, *Cumulative Index to Nursing and Allied Health Literature* (CINAHL), and *Web of Science*. The controlled descriptors (MeSH/DeCS) and related free terms used in the search were “Students, Nursing”, “Instructional Video”, “Teaching”, “Clinical Competence”, and “Cardiopulmonary Resuscitation”. They were combined using the Boolean operators "AND" and "OR". The complete search strategies were detailed in the revision protocol⁽²³⁾, which is available on the OSF platform.

Inclusion criteria included primary studies, with experimental and quasi-experimental designs, randomized or not, that compared the effectiveness of video in the development of clinical competence in CPR with other educational strategies applied to nursing students. There was no time limit for the search, which included studies in Portuguese, English, and Spanish, published in electronic scientific journals.

We excluded any studies that addressed nursing workers, literature reviews, editorials, reviews, experience reports, case studies, theoretical reflections, dissertations, theses, monographs, and abstracts from annals.

After databases were searched, the online version of the Rayyan[®] software (QCRI),⁽²⁴⁾ was used to manage studies and deal with duplicates. The eligibility of the studies was ascertained by two independent reviewers. At first, the papers underwent a triage, in which their titles and abstracts were read. Selected studies were then evaluated in full, to confirm whether they were eligible and extract relevant data. The exclusions were justified according to the predetermined criteria.

Later, the references of the studies included were verified, which did not lead to any studies being added to the final sample. Reviewers reached a consensus about any disagreements, and it was not necessary to bring in another reviewer. The selection and inclusion of studies are presented according to the recommendations of PRISMA⁽²¹⁾.

For data collection, we used an instrument proposed by Ursi and Galvão⁽²⁵⁾ and validated for literature reviews. This instrument was adapted for this study by adjusting its fields to the characteristics of the educational interventions and the outcomes analyzed, without prejudice to the original structure of the studies. These fields included: title, authors, year of publication, origin of the study, language, journal, objectives, methodological design, outcomes, and

conclusion. The evidence level of the studies was classified according to the hierarchy proposed by Melnyk and Fineout-Overholt⁽²⁶⁾.

Data extraction was performed by a single reviewer, using the instrument described above. The process was standardized, and information was extracted, verified, and discussed with the other authors whenever necessary to ensure data consistency and reliability.

For the purposes of this review, CPR clinical competence was evaluated considering three factors: theoretical knowledge, psychomotor skills, and professional attitudes, according to the outcomes evaluated in the studies that were included.

The methodological evaluation of the studies selected was conducted using the critical evaluation instruments of JBI^(27,28) and the Medical Education Research Study Quality Instrument (MERSQI)⁽²⁹⁾.

Due to the specific features of each tool, we decided to use both, improving our assessment of the methodological quality of the studies.

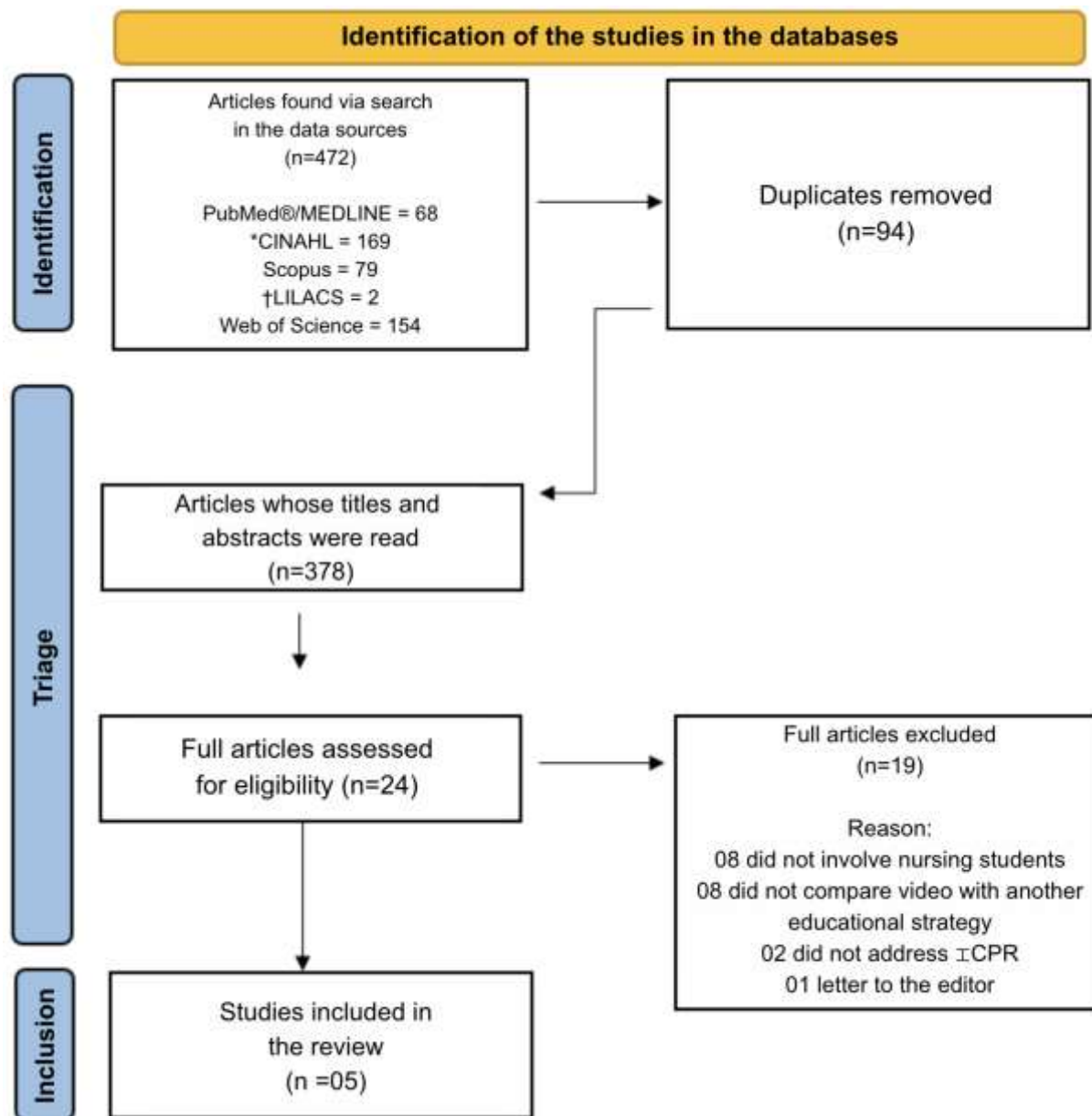
The JBI instrument has nine items focused on the methodological evaluation of quasi-experimental studies and 13 items for randomized studies, which are analyzed in regard to the presence, absence, clarity, and applicability of the criteria^(27,28). In turn, the MERSQI has six factors, which have criteria used to evaluate the methodological quality of studies by scoring them according to: (1) study design; (2) sample; (3) type of data; (4) validity of the assessment tool; (5) data analysis; and (6) results⁽²⁹⁾. The score of the assessment can be ≤ 10 , indicating low quality; >10 and <15 , indicating moderate quality; and ≥ 15 , indicating high quality. The maximum score is 18⁽³⁰⁾.

The evidence was summarized using descriptive and comparative analyses of the studies included, considering the data extracted and organized in Excel[®]. Thus, we were able to identify converging and diverging threads in our findings and to integrate results regarding the effectiveness of video-mediated teaching of CPR clinical competence.

Results

Figure 1 shows the selection and inclusion of studies in this review, according to the PRISMA recommendations⁽²¹⁾.

Figure 1 -Flowchart of the process of identification, selection, and inclusion of studies, adapted from PRISMA. Ribeirão Preto, SP, Brazil, 2025.



Source: The authors (2025).

*CINAHL = *Cumulative Index to Nursing and Allied Health Literature*; †LILACS = *Latin American and Caribbean Health Sciences Literature*; ‡CPR = *cardiopulmonary resuscitation*.

The studies included were published from 2000 to 2023. They were conducted in many different countries, such as Canada⁽³¹⁾; Spain⁽³²⁾; United States, Chile, and Argentina, for a multicenter investigation ⁽³³⁾; Egypt⁽³⁴⁾; and Turkey⁽³⁵⁾. Most studies had experimental and quasi-experimental designs, involving nursing undergraduates. The interventions used included the use of educational videos either in isolation or associated with other educational strategies, and were compared with traditional teaching methods.

In most cases, the effectiveness was measured according to outcomes related to theoretical knowledge and psychomotor skills of CPR. Some studies also evaluated the

satisfaction of participants regarding the teaching methods used. The studies were characterized in detail in Chart 1.

Chart 1 - Characterization of the studies that formed the sample of this systematic review. Ribeirão Preto, SP, Brazil, 2025. (continues)

Authors, year, and country	Objectives	Design	Sample (n)	Measurement of effectiveness	Results/conclusion	EL
Lieberman et al. ⁽³¹⁾ , 2000. Canada.	To compare the efficacy of four CPR [†] teaching methods, using manikins and videos in nursing students.	Quasi-experimental pilot study	n = 61	- Practical evaluation in a computerized manikin with feedback provided immediately and six months after the intervention.	There was no significant difference between the groups in regard to their understandings and groups with intensive practice and video had better early performance in the first assessment sequence, with $p < 0.05$. They concluded that the video is viable, agreeable, and as effective or perhaps more effective to teach CPR than the methods evaluated. It can also be cheaper and train large groups.	3
Spain.	To compare the immediate efficacy and the six-month efficacy of in-person teaching and the blended method, when teaching basic life support with a defibrillator for medicine and nursing students.	Randomized experimental trial	n = 129	- Multiple choice questionnaire (pre- and post-test); - Evaluation by an instructor using a checklist; - High-fidelity manikin with feedback.	There was no statistically significant difference in the knowledge of the groups. The median of the practical evaluation was significantly better for the experimental group both in an immediate evaluation ($p = 0.02$) and after six months ($p = 0.01$). They concluded that the blended method generates equal or superior levels of knowledge and skills when compared to in-person teaching.	2
Szyld et al. ⁽³³⁾ , 2021. US, Argentina, and Chile.	To compare the non-inferiority of self-directed videos with videos coupled with instructors to teach	Multicenter randomized clinical trial	n = 134	- OSCE [‡] (before and after) - Written test after the intervention.	Both groups showed competence in PPV. In the self-directed group, the rates were 92.6%, while in the group with an instructor, they were 89.4%. The approval rates in the OSCE were low, and the scores	2

	medicine and nursing undergraduates about positive pressure ventilation (PPV) during neonate reanimation.				in the theoretical evaluation were similar in both groups. The difference between the groups was 3.3%, with a unilateral CI of 95% (from -4.9 to 11.4), showing that the method of self-directed videos was not inferior and could be added to the standard training programs	
Hassan; Elsaman ⁽³⁴⁾ , 2022. Egypt.	To evaluate the effects of the inverted classroom model, based on video simulations, in regard to traditional simulations, in the acquisition of CPR skills by nursing students.	Randomized clinical trial.	n = 326	- Satisfaction Scale with the Simulation Experience; - Checklist of CPR Skills Acquisition.	The group that used the video was more satisfied with their experience with the simulation than the group that participated in a traditional simulation, with $p = 0.03$, and scored higher in the skills checklist, with $p = 0.01$, suggesting that the use of the video can be an efficient strategy to decrease the time needed for clinical CPR simulations.	2
Özdemir; Güngör; Cici ⁽³⁵⁾ , 2023. Turkey.	To compare the efficacy of a video and a traditional method in the teaching of pediatric CPR, and the satisfaction of nursing undergraduates.	Randomized experimental study.		- Multiple-choice questionnaire (before and after); - Checklist of practical CPR skills; - Questionnaire about satisfaction with the teaching method.	The group that used the video only had a better result in the first post-test ($p < 0.05$). In the final post-test of the skills and satisfaction of the students, there was no statistically significant difference between the groups ($p > 0.05$), and both methods were considered to be effective.	2

Source: The authors (2025).

*EL: Evidence level; † CPR: cardiopulmonary resuscitation; ‡ OSCE: objective structured clinical exam.

Chart 2, below, presents a critical evaluation of the methodological quality of the quasi-experimental study, according to the JBI evaluation instrument⁽²⁷⁾.

Chart 2 - Evaluation of quasi-experimental studies included in the review, according with the JBI instrument used to measure methodological quality. Ribeirão Preto, SP, Brazil, 2025.

Questions	Liberman, et al. ⁽³¹⁾
1. Is it clear, in the study, what is the "cause" and what is the "effect", that is, is there no confusion about which variable comes first?	Yes
2. Was there a control group?	Yes
3. Did the participants compared have similar characteristics?	Yes
4. Did the participants included in the groups receive similar treatments in the relevant intervention?	Yes
5. Were there multiple measurements of results, both before and after the interventino/exposure?	Yes
6. Were the results of the participants, in any comparisons, measured in the same way?	Yes
7. Were the results measured reliably?	Yes
8. Was the follow-up complete? If not, were the differences between the groups described and analyzed appropriately?	No
9. Were the appropriate statistical analyses used?	Yes

Source: The authors (2025).

The quasi-experimental study that was evaluated in this review was considered to be of good quality, as it fit most methodological evaluative criteria proposed by the JBI⁽²⁷⁾. The only criterion that was not met was that related to the complete follow-up of the groups.

As for the experimental studies, although most quality criteria were met, they had methodological shortcomings regarding the blinding of researchers, participants, those responsible for providing the treatment, and the evaluators, in regard to treatment allocation.

Chart 3 presents a critical evaluation of the methodological quality of the experimental studies, based on the JBI instrument⁽²⁸⁾. Chart 4, afterwards, presents a methodological evaluation of the studies, according to MERSQI⁽²⁹⁾.

Chart 3 - Evaluation of experimental studies included in the review, according to the JBI critical evaluation instrument. Ribeirão Preto, SP, Brazil, 2025.

Question	Castillo, et al. ⁽³²⁾	Szyld, et al. ⁽³³⁾	Hassan, Elsaman ⁽³⁴⁾	Özdemir, Güngör, Cici ⁽³⁵⁾
1. Were the patients allocated into treatment groups randomly?	Yes	Yes	Yes	Yes
2. Was the allocation of participants concealed (concealed allocation)?	Unclear	Yes	Yes	Unclear
3. Were the treatment groups similar?	Yes	Yes	Yes	Yes
4. Were participants blinded for the allocation of the treatment?	No	Yes	No	No
5. Were the professionals who applied the treatment blinded in regard to the allocation of the participants?	Unclear	Yes	No	No
6. Were the result evaluators blinded regarding the allocation of the treatment?	Yes	Yes	Unclear	Unclear
7. Was the treatment given to the groups during the relevant intervention identical?	Yes	Yes	Yes	Yes
8. Was the follow-up concluded, and, if not, were the differences between the groups, regarding the follow-up, appropriately described and analyzed?	No	Yes	Yes	Yes
9. Were participants analyzed in the groups into which they were allocated?	Yes	Yes	Yes	Yes
10. Were the results measured in the same way in both treatment groups?	Yes	Yes	Yes	Yes
11. Were the results measured in a reliable manner?	Yes	Yes	Yes	Yes
12. Was the statistical analysis used appropriate?	Yes	Yes	Yes	Yes
13. Was the design of the study appropriate? And were eventual deviations from the standard *RCT model considered during the conduct and analysis of the study?	Yes	Yes	Yes	Yes

Source: The authors (2025).

*RCT = Randomized clinical trial.

Chart 4 - Evaluation of the methodological quality of the studies, according with the MERSQI. Ribeirão Preto, SP, Brazil, 2025.

Factors	Liberman, et al. ⁽³¹⁾	Castillo, et al. ⁽³²⁾	Szyld, et al. ⁽³³⁾	Hassan, Elsaman ⁽³⁴⁾	Özdemir, Güngör, Cici ⁽³⁵⁾
Study design	Non-randomized study: 2 points	Randomized study: 3 points	*Multicenter RCT, double-blind: 3 points	Randomized study: 3 points	Randomized study: 3 points
Sample (number of centers and response rate)	One institution: 0.5 points 50%-74% response rate: 1 point	One institution: 0.5 points 50%-74% response rate: 1 point	Three countries: 1.5 points >75% response rate: 1.5 points	One institution: 0.5 points >75% response rate: 1.5 point	One institution: 0.5 points 50%-74% response rate: 1 point
Types of data/evaluation	Performance in a manikin: 2 points	Objective evaluation (manikin and video): 2 points	†OSCE and questionnaire: 2 points	Validated checklist and satisfaction: 2 points	Checklist and objective test: 2 points
Validity of the evaluation instrument	Did not report the validity: 0 points	Internal structure and content: 1 point Unreported relations: 0 points	Internal structure, content, and variable relationships: 3 points	Internal structure, content, and variable relationships: 3 points	Internal structure and content: 1 point Unreported relations: 0 points
Data analysis	Appropriate for the study design: 1 point Descriptive analysis: 1 point	Appropriate for the study design: 1 point In addition to the descriptive analysis: 2 points	Robust non-inferiority analysis: 2 points	Appropriate for the study design: 1 point In addition to the descriptive analysis: 2 points	Appropriate for the study design: 1 point In addition to the descriptive analysis: 2 points
Results	Knowledge and skill retention: 1 point	Knowledge and skills: 1.5 points	Knowledge and abilities + Satisfaction: 2.5 points	Knowledge and abilities + Satisfaction: 2.5 points	Knowledge and skills: 1.5 points
Total score	10.0	13.0	15.5	14.5	13.0

Source: The authors (2025).

*RCT = Randomized clinical trial; †OSCE: objective structured clinical examination.

The application of the MERSQI showed that, in general, the methodological quality of the studies was from moderate to high, with scores from 10 to 15.5 points and a mean of 13.2. The studies had methodological consistency with regard to their clarity and a causal relationship between the intervention and the outcome. The groups were homogeneous at the beginning of the studies, and they used standardized instruments to evaluate the results, including checklists based on recognized directives, simulations with digital feedback, and objective structured clinical examinations (OSCE).

There were also multiple measurements of the outcomes that were accompanied by appropriate statistical analysis, increasing the internal viability of the studies and contributing to the reliability of the data reported.

On the other hand, the main methodological weaknesses were related to the fact that the studies were conducted in only one center, and there was no clarification in regard to the validity of the evaluation instruments used.

In general, the performance of the videos in the studies included was not consistently superior to traditional teaching strategies. Most results indicated that the effectiveness of the methods was comparable, with statistically significant differences being observed in specific factors, especially in immediate practical evaluations, in the performance of specific skills, or in the levels of satisfaction of the participants. In one of the studies, conducted as a non-inferiority trial, video-mediated teaching was found to be equivalent to training conducted by an instructor, reiterating its potential as a complementary strategy for CPR teaching.

Most studies measured effectiveness using written tests, structured checklists, practical tests in manikins, and OSCE. However, it was found that no study evaluated attitudinal competences in a systematic manner. These include decision making, leadership, or teamwork, showing that the effectiveness of the video was measured, in most cases, in regard to the cognitive and psychomotor factors of clinical competence in CPR.

DISCUSSION

Four experimental studies⁽³³⁻³⁵⁾ and one quasi-experimental study⁽³¹⁾ were included in the final sample. Even if most authors pointed out that the video is a viable strategy for the development of the clinical competences^(31,32,34,35) in CPR of nursing students, the low number of studies found shows that there is a high demand for clinical investigations about this topic. This reiterates the need for caution when interpreting the results.

Most studies compared the video with skill training conducted with the aid of manikins, from low to high fidelity, with or without the presence of an instructor. One study compared

video usage with traditional classes⁽³⁵⁾; one, self-directed videos with videos with an instructor⁽³³⁾, and another compared simulation videos with traditional clinical simulations⁽³⁴⁾.

Even though most studies showed no statistically significant differences between the methods analyzed, the video was not found to be inferior, especially in regard to theoretical content. It showed better performance in the development of some practical skills, which can support its adoption in the teaching of CPR during nursing education, especially in the case of education that is focused on the teaching of specific practical skills, such as the execution of a certain technique. Further investigation is necessary regarding neonate CPR in simulated environments^(2,31,32,34,35).

This information is corroborated by a systematic review and meta-analysis that was conducted to evaluate the impact of video-based approaches in health education, which analyzed 40 studies⁽²⁾. The results have shown that video based learning had a moderate effect on "skill development" in nursing (Cohen's $d = 0.59$), with a moderate general effect over "attitude" (Cohen's $d = 0.74$), which led to the conclusion that the video can be a valuable educational tool for the acquisition of knowledge, the development of skills, and for changes in attitude in health education⁽²⁾.

Furthermore, combining videos with other pedagogical strategies was found to be highly beneficial to the teaching-learning process, in which case the video supplements the process by attending to demands that no method in isolation meets. Studies conducted by Portuguese ⁽²⁾ and Pakistani ⁽³⁶⁾ researchers, conducted by health workers and medical students, have shown that the integration of videos with strategies such as clinical simulations and case studies promotes significant improvements in knowledge, skills, and attitudes, including improvements in self-efficacy, content retention, and performance in evaluations such as the OSCE.

Another study evaluated whether videos are a beneficial method to teach psychomotor abilities in nursing⁽⁴⁾. Nine psychomotor abilities were presented in the articles found, providing strong support for the use of videos as educational tools, as long as these videos are high-quality and based on evidence, since their use during the process of learning specific clinical skills led not only to a better technical performance of participants, but also to an increase in their levels of knowledge and self-confidence⁽⁴⁾.

Contemporary directives for education in CPR involve clinical competences, such as the integration of knowledge, psychomotor abilities, and professional attitudes, emphasizing that a competent CPR performance does not require merely an adequate performance of the technique, but also appropriate decision-making, efficient communication, and teamwork^(5,18). Thus, to be competent in CPR, a student must have conceptual knowledge about how to

recognize CPA, in which order to provide attention, use of devices, technical skills compatible with recommended quality parameters, and professional attitudes that are appropriate to critical and time-sensitive contexts^(5,18).

In the studies included in this review, however, the results and the operationalization of the concept of clinical competence were mostly restricted to the cognitive, psychomotor, and technical factors⁽³¹⁻³⁵⁾.

In most cases, the effectiveness of the interventions was evaluated using tests of theoretical knowledge^(32,33,35) and instruments to evaluate the practice⁽³²⁻³⁵⁾, such as checklists and the OSCE, which are targeted at compressions, ventilation, and order of actions. No study included specific instruments to measure attitudinal competences, such as leadership, decision-making, communication, and teamwork. By doing so, they circumscribe the concept of clinical competence as something mostly technical and individual.

These findings show that studies that measure educational effectiveness with nursing undergraduates do not entirely comply with current recommendations regarding how to assess competence-based education. This result is in accordance with investigations according to which the evaluation of clinical competences is often heterogeneous and difficult, especially in the attitudinal factor. This is a gap to be explored in future studies^(16,17).

Thus, the methodological analysis of the studies found, conducted using JBI critical evaluation criteria and by applying the MERSQI, enabled a systematic appreciation of the consistency, validity, and robustness of the methodological designs employed. The focus in nursing graduates, in turn, is a unique feature when it comes to previous studies on educational technologies as applied to CPR.

The individual analyses of the studies included enabled identifying common methodological standards, such as recurring shortcomings associated with study design and strategies related to outcome evaluation⁽⁶⁾.

In general, the methodological quality found went from moderate to high, presenting clarity in the relationship between intervention and outcome; homogeneity in the groups in the beginning; and the use of structured instruments to evaluate performance, including checklists, OSCE, and simulators with feedback.

Nonetheless, there were methodological shortcomings in the educational studies with interventions. Among them, stand out limitations related to the concealment of allocation and the lack of strategies to blind the participants, instructors, and evaluators, limitations that are present in most studies included. Blinding may be a challenge inherent to educational research, but its absence can compromise the internal validity and the reliability of the inferences,

increasing the risk of biases in performance and detection, in addition to making contamination between groups a possibility⁽⁶⁾.

Another relevant aspect is related to the follow-up of participants. In some studies, sample losses were not clearly described or considered in the analysis. Furthermore, the methodological strategy of analysis by intention to treat, which is recognized as a good practice in randomized clinical trials, was not well explored in most studies, compromising the robustness of the findings.

We also identified shortcomings related to sample limitations, such as the predominance of studies conducted in a single center, and the lack of formal validation of some of the instruments used. These limitations were found, especially, in regard to internal consistency and the relationship with other variables, which can compromise the reliability of the conclusions found.

Although multicenter clinical trials are considered to be the gold standard of research, as they make it possible to better represent the population and can be executed in a shorter period, they tend to be more difficult to execute due to their high cost and logistical complexity. This can explain why educational studies in nursing are developed in single centers⁽³⁷⁾.

According to this gold standard, the validation of the instruments used is an essential criterion to ensure the methodological quality of the studies, since they ensure that the findings are reliable. The lack of clear information about this in the studies included in this review can compromise the reliability of their statistical conclusions, explaining the fact that their methodological classification was considered to be moderate⁽¹⁷⁾.

Similar results were found in a systematic review about simulation-supported education in nursing. That review also used the MERSQI instrument and, within a sample of 28 studies, found that most had a moderate methodological quality⁽³⁸⁾. This review highlighted the need to improve the design of educational interventions in nursing, especially due to the predominance of studies conducted in only one location, and the fact that few instruments being used had been previously validated in literature.

From an interpretative point of view, the methodological shortcomings found in the studies require one to be careful when analyzing the effectiveness of video-mediated interventions. The lack of blinding and allocation concealment can influence the estimation of effects, especially in outcomes related to performance. Nevertheless, literature suggests that the adoption of more objective measurement strategies, such as the use of structured checklists, OSCE, simulators with automated feedback, and instruments based on directives and submitted

to specialist validation, can reduce the influence of measurement bias, increasing the consistency of evaluations^(39,40).

The predominance of studies conducted in only one location, in addition to the variance in quality and in the reporting of the validation of the instruments used, limits our ability to compare our findings and to generalize our findings to other educational contexts. Thus, to interpret the effectiveness of interventions, we must consider the designs adopted, the characteristics of the educational settings, and the degree to which the measures employed are robust and standardized.

Although the evidence included comes from international contexts, literature suggests that the use of educational videos can be applied to different educational realities, including high-income countries and settings with limited resources.

In nursing teaching, this strategy can support curricular planning, especially for the practical component of urgency and emergency teaching, as it favors hybrid training models. Furthermore, the video can optimize the time spent in practical activities, increase the reach of CPR training, and give support to permanent education actions in clinical environments^(5,41).

The results of the studies show that some of the mechanisms involved in the effectiveness of video-mediated teaching can be related to certain characteristics that are inherent to this tool. A characteristic that stands out is the possibility of standardizing the demonstration of procedures, ensuring that all students have access to a consistent presentation of the stages of CPA. This reduces instructional variability and makes the learning process more uniform⁽²⁾.

Another relevant mechanism pointed out in literature is the flexibility and accessibility of video, allowing for self-directed repetition of the content, control of the rhythm of learning, and increasing student engagement^(2,42). Asynchronous access makes it possible to rewatch critical steps as many times as necessary, helping consolidate knowledge and improve psychomotor abilities, especially in sequential and time-sensitive procedures, such as thoracic compressions and ventilation.

This study has limitations that must be considered when interpreting its findings. The lack of experimental and quasi-experimental researches about the use of video to develop clinical competences in cardiopulmonary resuscitation among nursing undergraduates limits the possibility of generalizing these results. Restricting the languages used may have limited the finding of studies published in other languages. Furthermore, the instruments used to evaluate clinical competence in the studies were quite varied, hindering our ability to directly compare our findings.

Nonetheless, this systematic review has relevant contributions to the advance in the scientific knowledge in the field of health, especially in nursing. The results presented here expand our understanding of the use of video when teaching CPR, and provide subsidies to develop future studies in the field. More specifically, it shows that future investigations need more robust methodological planning, with special consideration to the adoption of strategies that can reduce potential biases and lead to more transparency in the process of conducting and analyzing the trials. These improvements are essential to increase the credibility of the findings and favor their application in educational and clinical contexts.

CONCLUSION

Video-mediated teaching was found to be effective in developing clinical competences in cardiopulmonary resuscitation in nursing undergraduates. It was found to be a useful pedagogical tool, whose effectiveness is comparable to traditional educational strategies, with a superior performance when associated with other pedagogical approaches, in addition to its relevance in the development of specific psychomotor skills. Its use contributes to the theoretical understanding and ability to apply the maneuvers in practice, and can be employed in a self-directed manner or with support from an instructor, improving education quality and the performance of students.

It also has an impact on health management and care, as it helps in the standardization of training, the acquisition of essential clinical competences, and in supporting the organization of programs of training, permanent education, and continuing professional development, especially in contexts in which time, resources, or instructor availability are scarce. There are still gaps regarding the effectiveness of video when teaching complete neonatal resuscitation in simulated environments, and in the development of attitudinal competences, such as communication, leadership, and teamwork, showing the need for further investigation.

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Availability of data and materials

The set of data can be accessed upon request to the corresponding author. The data that support the results of this study are available in the manuscript and its supplementary materials.

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