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Teaching Methods of Basic Life Support (Bls) and Their Effects on School Students' Skills: A Literature Review

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Abstract

Background: Basic Life Support (BLS) is a series of emergency interventions performed to restore and maintain vital body functions in individuals experiencing cardiac arrest or respiratory arrest. Adequate knowledge and skills among school students are essential to ensure that first aid can be provided correctly and promptly, thereby preventing mortality.
Purpose: This literature review aims to describe various effective teaching methods used in Basic Life Support (BLS) training for school students.
Methods: This study employed a literature review method by searching relevant articles from three electronic databases: PubMed, Cochrane, and ScienceDirect. The search strategy was developed using the PICO framework. Inclusion criteria included articles published within the last 10 years, focusing on BLS training for school students aged 11–16 years, available in full text, written in English or Indonesian, and using a Randomized Controlled Trial (RCT) design. The PRISMA flow diagram was used to select articles, resulting in four eligible studies, which were critically appraised using the JBI Critical Appraisal Checklist.
Results: All four reviewed studies reported that digital-based learning methods were more effective in improving BLS knowledge and skills among school students compared to conventional teaching methods.
Conclusion: Various teaching methods have been proven effective in improving students' knowledge and skills in BLS. Engaging and innovative training approaches can be considered as effective strategies for BLS education among school students.

Background

Basic Life Support (BLS) is a set of emergency actions performed to restore and maintain vital body functions in individuals experiencing cardiac arrest or respiratory arrest. These actions include chest compressions and rescue breathing (Hardisman, 2014). BLS, particularly in the context of resuscitation, plays a crucial role in determining survival outcomes in cardiac arrest victims. Almost all aspects of resuscitation from recognizing cardiopulmonary disturbances, managing cardiac arrest, performing resuscitative measures, to post-cardiac arrest care and restoring patients to productive lives are essential components of emergency care (Neumar et al., 2015). Ethical considerations are also integral to resuscitation practice. Healthcare providers often face ethical dilemmas when making decisions regarding cardiovascular interventions in emergency situations (Neumar et al., 2015)

According to the World Health Organization (WHO), cardiovascular diseases accounted for more than 17 million deaths globally in 2019, representing approximately 31% of all global deaths, with coronary heart disease being the leading cause (WHO, 2025). In Indonesia, approximately 15 per 1,000 individuals equivalent to around 2.78 million people suffer from heart disease (Aspar, 2022). Indonesia

currently faces a dual burden of disease, where communicable diseases remain prevalent while non-communicable diseases, particularly cardiovascular diseases, continue to rise significantly (Kemenkes, 2019). The prevalence of heart disease based on physician diagnosis among the population in North Kalimantan Province was 4,000 cases in males and 3,574 cases in females (Riset Kesehatan Dasar Kalimantan Utara, 2019). Cardiac arrest occurs when the heart muscle is deprived of blood and oxygen, usually due to obstruction of the coronary arteries by a blood clot or because the heart is unable to pump blood effectively. Under these conditions, the individual loses consciousness, stops breathing, and has no detectable pulse (Clinic, 2024)

Cardiac arrest is a medical emergency that requires immediate initial management in the form of Basic Life Support (BLS). The implementation of BLS follows the guidelines of the Chain of Survival (Panchal et al., 2020). The application of Basic Life Support based on the chain of survival principle has been proven to increase the success rate of the return of spontaneous circulation. A study conducted in the United States by the CARES registry reported that among approximately 350,000 cases of cardiac arrest, victims who received early BLS interventions such as chest compressions and defibrillation using an automated external defibrillator (AED) by bystanders had a survival rate of 37.1%, whereas victims who received assistance only after ambulance arrival had a survival rate of 12% (Chen et al., 2019). These data indicate that the earlier cardiac arrest management is initiated, the greater the individual's chance of survival.

A bystander is a non-medical individual present at the scene of a cardiac arrest and is expected to provide initial assistance. Research findings show that out of approximately 2,000 cardiac arrest cases, only 36.5% of laypersons were willing to provide help (Dobbie et al., 2018). Other studies have revealed that fear of worsening the victim's condition is closely associated with the level of knowledge and prior education received (Kusumawati et al., 2023). Therefore, adequate knowledge, attitudes, and skills in providing Basic Life Support are essential. For this reason, BLS education during adolescence is particularly important so that first aid for victims of illness or accidents can be delivered appropriately and prevent mortality (Maria, 2019)

Schools play a crucial role in providing access to health education, as reflected by students' high interest in participating in Basic Life Support training programs. BLS education at the school age has been shown to have a significant impact, as students have the potential to disseminate this knowledge to family members at home. Children aged 7–14 years are capable of performing BLS, and those aged 13–14 years can achieve performance quality comparable to that of adults (Nolan et al., 2020)

To date, Basic Life Support training has generally been conducted using conventional methods through face-to-face sessions with instructors and hands-on practice using manikins. While this method has been shown to improve participants' understanding, knowledge retention tends to decline within six months. Several self-directed learning–based approaches have been developed and proven effective

in enhancing comprehension and maintaining knowledge retention, as learning materials can be studied independently and repeatedly at home (Kim et al., 2014). Based on this background, the present study aims to address the following research question: "What are the most effective Basic Life Support teaching methods for school-aged children?"

Method

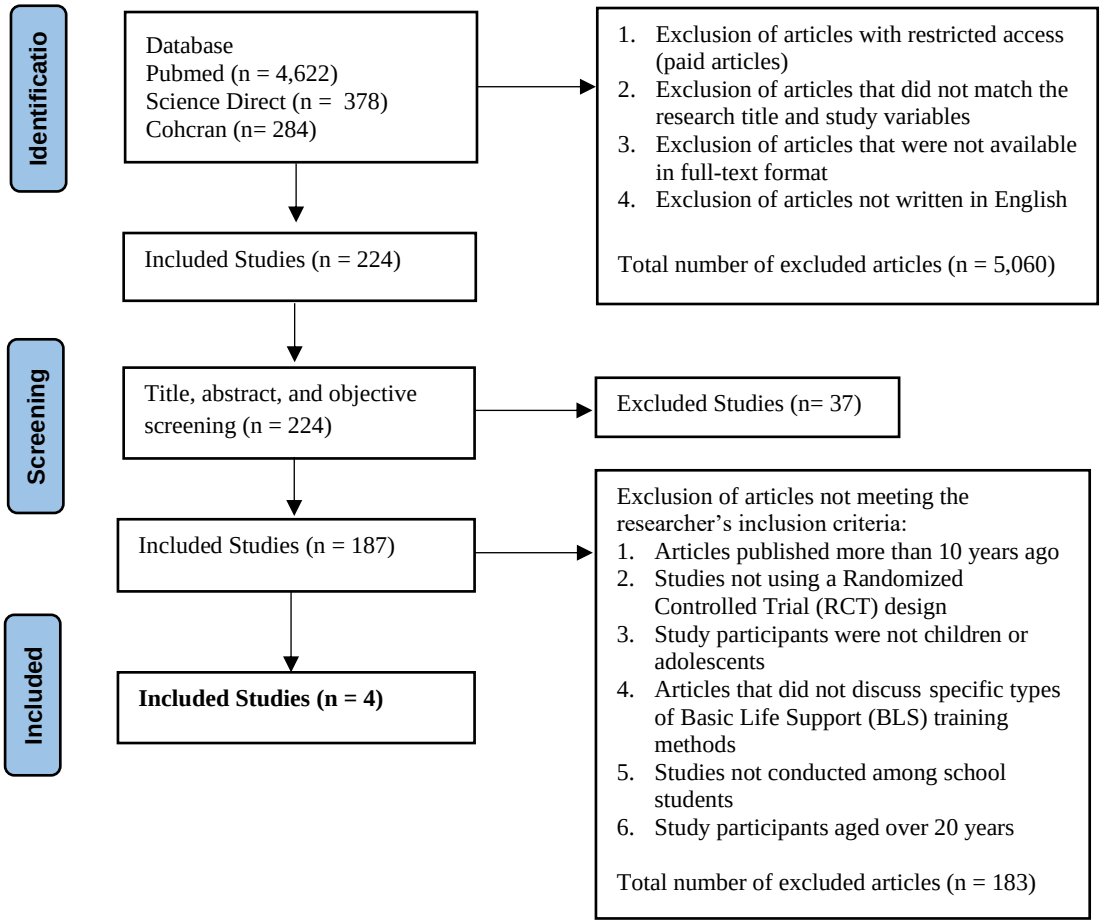
This study employed a literature review method by searching for relevant articles through electronic databases. The research question was formulated using the PICO approach (Leonardo R, 2018). The literature search process was conducted using specific keywords across several electronic databases, including:

Table 1. Keyword Search Strategy

Database	Keyword
Pubmed	training method" AND "basic life support" AND "training" OR "knowledge" AND "students",.
COCHRANE	basic life support AND train AND student
Sciencedirect	"BLS training" AND "high school students" AND "practical skills" OR Basic Life Support" AND "training methods" AND "school children" AND "skills"

Article collection and selection were conducted using the PRISMA flow diagram (Calhoun & Douglas, 2015). The inclusion criteria consisted of articles that discussed Basic Life Support (BLS) training methods, were conducted among school-aged children or adolescents, were written in English, and were available in full-text format. Articles were excluded if they were published more than 10 years ago, did not employ a Randomized Controlled Trial (RCT) study design, or only presented frequency distributions without evaluating the effectiveness of the training methods used.

Diagram PRISMA



The literature search was conducted using three databases and combined using the Boolean operators OR and AND, resulting in 4,622 articles from PubMed, 284 articles from the Cochrane Library, and 378 articles from ScienceDirect. The next step involved screening based on titles and abstracts conducted by the researchers. Articles that met the inclusion criteria were then selected according to the predefined inclusion and exclusion criteria, resulting in 187 articles from the three databases. The final step involved verifying open-access availability from each database, which resulted in four final articles included in the review.

Results

Table 2. Characteristics and Assessment of Included Studies

Author	Study Design
Doucet, et al	Randomized Control Trial
S. Tanaka et al	Randomized Control Trial
H. Chamdawala	Randomized Control Trial
Molinari et al	Randomized Control Trial

A total of four articles were included for analysis. All included articles employed the same methodological approach, as presented in the table. The four studies were conducted using a Randomized Controlled Trial (RCT) design.

Table 3. Summary of Articles Retrieved from Databases

Author(s), Year, Country	Objective	Study Subjects	Method	Result
(Molinari et al 2025), UK	The purpose of this study was to determine whether school students aged 11–16 years were able to retain and demonstrate Basic Life Support (BLS) or cardiopulmonary resuscitation (CPR) skills six months after receiving a single training session.	The study subjects were school students aged 11 to 16 years. They were recruited from six schools located in the city of Caxias do Sul, Brazil. A total of 198 students participated until the completion of the study.	This study employed an experimental method known as a simulation-based Randomized Controlled Trial (RCT), conducted in 2024 among school students aged 11 to 16 years in Brazil. The participants were divided into two groups: an Intervention Group that received a single session of theoretical and practical Basic Life Support (BLS) training delivered by medical students using manikins, and a Control Group that did not receive any training. Six months after the training, both groups were reassessed to evaluate their retention of the taught knowledge and skills. The assessment was conducted through simulated cardiac arrest scenarios using specialized manikins capable of automatically measuring chest compression quality, including depth and rate.	The results of this study demonstrated that the training intervention had a significant positive impact on the students. After six months, the group of students who had received training performed substantially better than the untrained group in both theoretical understanding and practical skills. Students in the trained group were more proficient in performing the complete rescue sequence, from recognizing an emergency situation to providing appropriate assistance. Technically, the quality of chest compressions performed by the trained group achieved a mean score of 51.71, whereas the untrained group achieved a mean score of only 17.81. This marked difference indicates that even a single training session delivered by medical students was sufficient to ensure that school students retained adequate knowledge and skills for at least six months.
(Doucet., 2019), Belgia	This study aimed to evaluate the effectiveness of an app-based self-teaching method as an alternative approach in cardiopulmonary resuscitation (CPR) education for school students.	The study subjects were school students, consisting of 165 participants aged between 16 and 18 years.	This study employed a Randomized Controlled Trial (RCT) design involving 165 participants aged 16 to 18 years. The participants were divided into two groups: a control group receiving instructor-led training and an intervention group receiving training through a tablet-based application. Both groups were allocated 40 minutes of training in separate classrooms, supported by manikins and Automated External Defibrillator (AED) simulation devices.	The results showed that there was no statistically significant overall difference in teaching effectiveness between the two groups, with a significance value of p = 0.304. These findings indicate that, in general, app-based self-directed learning demonstrates effectiveness comparable to conventional instructor-led training. However, based on further sub-analyses of specific skill components, the instructor-led group demonstrated significantly better performance in several specific skills, including airway assessment (p = 0.018), procedures for using an Automated External Defibrillator

				(AED) ($p < 0.01$), and shock delivery actions ($p = 0.002$).
(Tanaka et al., 2019), Jepang	This study aimed to determine whether the latest QCPR Classroom training method is significantly more effective than standard CPR training in improving the quality of chest compressions.	This study involved 642 laypersons in Japan who were participating in CPR training programs. The participants were aged over 15 years. For the final analysis, the researchers screened the data and obtained a total of 497 eligible participants whose data were included. This total was divided into two groups: 259 participants in the standard CPR training group and 238 participants in the QCPR Classroom training group.	A Randomized Controlled Trial (RCT) was conducted by comparing interventions between two groups: a control group receiving standard CPR training and an intervention group receiving QCPR Classroom training.	Based on the study data, the group trained using the QCPR Classroom method demonstrated statistically significantly better outcomes compared to the standard training group. In terms of compression depth, the QCPR group achieved a mean depth of 59.5 mm, whereas the standard group achieved 56.1 mm. The success rate of achieving adequate compression depth increased by 39% in the QCPR group, which was approximately twice as high as the increase observed in the standard group (20%) ($p < 0.0001$). Moreover, the most pronounced difference was observed in complete chest recoil technique. The QCPR group demonstrated a 22.6% improvement in recoil quality, while the standard group showed minimal improvement, with an increase of only 2.7%. Regarding compression rate, the QCPR group maintained a more stable rate at 116.8 compressions per minute, which was closer to the ideal standard compared to the control group, which recorded a rate of 119.2 compressions per minute.
(Chamdawala et al., 2021) USA	This study aimed to determine whether the use of real-time visual feedback devices could improve high school students' ability to perform cardiopulmonary resuscitation (CPR) techniques. The researchers sought to examine two primary outcomes: first, the extent to which the device facilitated faster acquisition of CPR skills; and second, how well students	The respondents in this study were high school students in the United States. A total of 220 students were included in the final analysis. The students were evenly divided into two comparison groups: 110 students were assigned to the Feedback Group, which trained using real-time visual feedback devices, and the remaining	This study employed a randomized trial method to compare two CPR training approaches. Initially, all students underwent baseline skill assessment and received standard instructor-led CPR training. Subsequently, the students were randomly assigned to two groups: the Feedback Group, which practiced for 2 minutes using real-time visual feedback devices, and the Standard Group, which practiced using standard manikins only. Students' performance quality was measured using a "compression score," which assessed compression depth, rate,	Based on the analysis of 220 students, this study found that the use of real-time visual feedback devices had a substantial impact during the early phase of learning. Immediately after training (week 0), the Feedback Group achieved significantly higher compression quality scores than the Standard Group, with a performance advantage of 20% ($p < 0.001$). This significant advantage persisted through follow-up assessments at week 10 and week 28. However, over time, the performance gap between the two groups gradually narrowed. At the final assessment conducted at

	were able to retain and maintain these skills over a one-year period compared with students who received standard instructor-led training.	110 students were assigned to the Standard Group, which trained using standard manikins without visual feedback.	hand position, and chest recoil. To evaluate skill retention over time, follow-up assessments were conducted at multiple time points: immediately after training (week 0), at week 10, week 28, and one year later (week 52).	week 52 (one year later), the data indicated no significant difference between students who trained using visual feedback devices and those who received standard training. These findings suggest that while visual feedback devices are highly effective in accelerating skill acquisition, the acquired skills tend to decline after one year in the absence of additional refresher training.

Critical appraisal was conducted using a systematic assessment consisting of 13 questions to evaluate the validity, results, and relevance of four Randomized Controlled Trial (RCT) articles. The appraisal process utilized the JBI Critical Appraisal Checklist for Randomized Controlled Trials**,** with three possible response options for each item: Yes, No, and Unclear (Tufanaru et al., 2020)

Tabel Criticial Appraisial Randomized Control Trial

Question	Molinari et al	Doucet	Tanaka et al	Chamdawala et al
Were the study participants and group allocation randomized?	Yes	Yes	Yes	Yes
Was allocation to treatment groups concealed (Blind)?	Yes	Yes	Yes	Yes
Were the treatment and control groups similar at baseline?	Yes	Yes	Yes	Yes
Were participants blinded to the intervention they received?	No	No	No	No
Were those delivering the intervention blinded to group allocation?	Yes	Yes	Yes	Yes
Were outcome assessors blinded to group allocation?	Yes	Yes	Yes	Yes
Were the intervention and control groups treated identically other than the intervention of interest?	Yes	Yes	Yes	Yes
Were outcomes measured in the same way for the intervention and control groups, and was follow-up complete or adequately addressed if incomplete?	**Follow-up** The researchers conducted a comprehensive evaluation by not only assessing outcomes immediately after the simulation (immediate post-test), but also performing a follow-up assessment six months later to measure skill retention among	**Follow-up** Following the intervention, a follow-up evaluation categorized as T1 (post-intervention assessment) was conducted for both groups of participants, including those who received training via a tablet-based application and those who received direct instruction. At this stage, the researchers carried out a comprehensive	**Follow-up** The researchers conducted a follow-up assessment of respondents' **CPR quality** by comparing two groups: **Control Group:** Monitored manually and subjectively by an instructor only. **Intervention Group (QCPR**	**Follow-up** in This Study The researchers did not assess students only once after the training. Instead, they conducted periodic follow-up assessments over a full one-year period to examine the long-term retention of CPR knowledge and skills among students. **Assessment Schedule:** evaluations were performed immediately after training (Week 0), and subsequently at

Question	Molinari et al	Doucet	Tanaka et al	Chamdawala et al
	respondents. This follow-up is crucial to determine whether the life-saving skills were still retained or had declined over time. This study demonstrates evidence of adequate analytical rigor through the following approaches: 1. The application of an intention-to-treat analysis**,** 2. Blinding of outcome assessors**,** and 3. The use of RStudio for data analysis, indicating that follow-up outcomes were examined using rigorous quantitative methods to determine the statistical significance of differences between the simulation group and the non-simulation group.	assessment to evaluate each component of Basic Life Support (BLS) skills in detail, including: 1. Assessment of checking the victim's level of consciousness. 2. Assessment of proper breathing assessment techniques. 3. Assessment of procedures for calling emergency medical services and requesting an automated external defibrillator (AED). 4. Assessment of the quality of chest compressions**,** including depth and rate. 5. Assessment of the technique for providing rescue breaths. 6. Assessment of the correct use of an automated external defibrillator (AED).	**Classroom):** Monitored comprehensively using sensor-based technology, providing objective measurements with real-time feedback displayed on a monitor.	Week 10, Week 28, and Week 52 (one year).
Were participants analyzed in the groups to which they were randomized?	Yes	Yes	Yes	Yes
Were the measurements conducted in the same way for both groups?	Yes	Yes	Yes	Yes
Were the outcome measurements conducted in a valid and appropriate manner?	Yes	Yes	Yes	Yes
Were the statistical tests used adequately described and appropriate for the analysis?	Yes	Yes	Yes	Yes

Question	Molinari et al	Doucet	Tanaka et al	Chamdawala et al
Was the experimental design appropriate to address the research topic, and did it differ in terms of methodology or analytical approach from a standard randomized controlled trial (RCT)?	The study generally adhered to the standards of a randomized controlled trial (RCT); however, there were some differences in data handling compared with a standard RCT, including the absence of double blinding and the lack of a placebo in the control group	This study employed a standard parallel-group randomized controlled trial (RCT) design	This study employed a cluster randomized controlled trial (RCT) design, as it aimed to compare the effectiveness of the standard (conventional) CPR training method with the 'QCPR Classroom' method.	Although this study adopted the standards of a randomized controlled trial (RCT), several practical modifications were made due to its implementation in a school setting rather than in a laboratory or hospital environment. One major adaptation concerned the blinding procedure; double blinding was not feasible because participants were consciously aware of the type of learning media they used, whether sensor-based mannequins with visual feedback or conventional mannequins.

Discussion

Several of the analyzed studies involved participants with a wide age range, from 10 to 18 years. A variety of methods were employed to enhance students' Basic Life Support (BLS) skills, including:

Learning approaches that integrated theoretical instruction with hands-on practice using mannequins were shown to have a positive impact on students six months after training, both in terms of conceptual understanding and mastery of the correct sequence of life-saving procedures. The most pronounced difference was observed in the quality of chest compressions; students who had received training demonstrated significantly better performance compared with those who had not. Statistically, this improvement in skills was found to be highly significant (Molinari et al., 2025)

Learning methods that integrate Basic Life Support (BLS) theory and practice using an Automated External Defibrillator (AED) simulation application for 40 minutes demonstrated that students' levels of BLS knowledge and skills were comparable to those of students who underwent conventional learning methods (Doucet et al., 2018) Learning methods based on the Quality Cardiopulmonary Resuscitation (QCPR) concept were shown to be effective in delivering optimal CPR training outcomes among students, even with a more limited number of instructors (Tanaka et al., 2019).

Learning methods that incorporated real-time visual feedback were also proven effective, demonstrating significantly superior performance in chest compression techniques compared with conventional methods. However, in terms of students' overall BLS knowledge, no meaningful differences were observed between the two approaches (Chamdawala et al., 2021). From the various methods identified to enhance knowledge and skills, BLS training is considered highly important for adolescents and school-aged children. This aligns with recommendations from the American Heart Association, which emphasize that children and adolescents are capable of saving lives. Training school students in BLS

can equip an entire generation to respond effectively to cardiac arrest and improve out-of-hospital survival rates (Schroeder et al., 2023). Across the five reviewed articles, all instructional methods were found to successfully improve BLS skills. Furthermore, the duration and frequency of BLS training should follow AHA recommendations, which state that resuscitation knowledge and skills may decline within 3 to 12 months after training (Ecc, 2020).

Conclusion

BLS training for students not only enhances their knowledge and technical skills but also builds confidence in providing emergency assistance. The effectiveness of various instructional models has been validated across different educational levels. Moreover, the adoption of innovations such as mobile applications, visual feedback devices, and peer tutoring has been shown to facilitate students' understanding and retention of the material presented.

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