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RESEARCH **Open Access**

Development of Learning Methods Basic Life Support Based on E-Learning Program for Nurses: Literature Review

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Abstract
Basic Life Support (BLS) training is a must for nurses before entering the world of work. During the establishment of the pandemic in Indonesia, many face-to-face interactions were limited. The limitation also impacts the learning method of nurses. Most of the institutions use the E-learning (online) method. E-learning in nursing study has several advantages, such as being efficient, economical, and flexible. However, it also has disadvantages such as internet access, lack of interaction, and lack of direct practice with the media. This literature review aims to find the best e-learning methods for BLS training. The research design is a literature review. The article was conducted in three journal databases: Google Scholar, Scopus, and PubMed. A total of 16 articles that met the inclusion criteria were reviewed. The study showed that blended learning is the best recommended learning method for BLS. Combined learning methods improve the knowledge and skill performance of the students.

Keywords: E-learning, Learning Methods, Nursing, Basic Life Support.

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1. INTRODUCTION

The rapid development of information and communication technology in the digitalization era encourages various educational institutions to utilize e-learning systems. E-learning-based training is one of the system implementation forms. The purpose of e-learning-based training is to increase the effectiveness and flexibility of learning. Although many research results showed that the effectiveness of learning using an e-learning system tends to be the same as conventional or classical learning, the advantage of e-learning is its flexibility (Yahiaoui et al., 2022). Through e-learning, the materials can be accessed anytime and anywhere. The materials also can be enriched with various learning resources, including multimedia, that the teacher can quickly update. Due to the relatively new development of e-learning, the definition and implementation of e-learning systems vary significantly, and a standardized standard needs to be established (Sheikhaboumasoudi et al., 2018). Based on observations, the implementation of e-learning systems varies from the simple one, just a collection of learning materials placed on a web server with additional online communication forums, to the integrated one, an e-learning portal containing multiple learning objects and academic information. As for the actual teaching and learning process, especially in countries where the Internet connection is prolonged, e-learning systems can be combined with a conventional learning system known as blended learning or hybrid learning systems (Picciano, et al., 2022).

Flexibility is the keyword in an e-learning system. Learners become very flexible in choosing the time and place of learning because they do not have to come somewhere at a particular time. On the other hand, teachers can update their learning materials anytime and anywhere. Learning materials can be made very flexible in content, ranging from text-based materials to learning materials loaded with multimedia components. However, the quality of learning with e-learning is also very flexible or varied, which can be worse or better than face-to-face learning systems (conventional). To get an excellent e-learning system, we need to build an excellent design too (Suartama, 2014; Nurhasanah, et al., 2019).

E-learning can be used in various training and learning, especially in applying basic life support training (Adnyani, et al., 2023). BLS training, which takes references from the American Heart Association (American Heart Association, 2020), is widely used as a material reference for training health workers and non-experts. BLS training can increase the community's understanding, increase knowledge, and increase the ability to practice, and the community can spread the information to friends and others (Agustini, et al., 2017; Nurjanah, & Suparti, 2022; Rahman, et al., 2022). The implementation of training during the pandemic has experienced difficulties. All face-to-face activities are limited, including training or learning. The limited face-to-face activity has caused many e-learning-based learning models designed to support ideal learning, like face-to-face learning, to emerge (Singh, et al., 2021).

Although the e-learning design has been designed in such a way, it still has some obstacles for the users. A study by Taher, et al., (2022) states that 64.8% of students are not satisfied with implementing e-learning. Only 35.5% of students take electronic classes. The obstacles felt by students are slow internet speeds, electrical interference, and lack of face-to-face interaction. The results of this study are also supported by the data on the achievement of e-learning implementation in the Bunda Group Corporation, where the Workspace Completion Rate (Corp et al. Method) reached 74% in 2022 so that SP (Warning Letter) was imposed in the form of punishment from the corp which was used to increase the completion rate to 98.6%, but this could not increase nurses' interest in learning (Dempsey et al., 2021).

Other data that can be used as the basis for taking this theme is the success rate of implementing cardiopulmonary resuscitation in hospital service units in 2022. The success rate did not reach 80% even though mandatory BLS training has been carried out using the e-

learning method. The result showed that the e-learning method is ineffective in ensuring success in practical skills (Joshi et al., 2022).

So, from this gap and existing problems, researchers are interested in conducting a literature review article to find a suitable e-learning-based BLS learning model for nurses to enhance their interest in learning and improve their skills and knowledge.

2. RESEARCH METHOD

This research was conducted using the literature review method. A literature review is a scientific approach that aims to analyze, evaluate, synthesize, and criticize a research finding on a particular topic or topic that has been published online and in print. The selected articles are from research on applying the e-learning-based nurse basic life support learning model to increase interest in learning. The strategy used to search for articles uses the PICOS framework, as explained in Table 1.

Table 1. PICOS Literature Review.

Criteria	Inclusion	Exclusion
Population	Nurse, Nursing, Medical Student	Not nurse, not medical students
Intervention	E-learning methods, blended learning	Not seminars or symposia, or workshops
Comparators	Not described	Not described
Outcomes	Best E-learning methods for Basic Life Support	Not explain about training methods or e-learning methods for BLS
Study Design and publication type	Quasi-experimental studies, Qualitative survey or research, Cross-sectional Survey randomized control and trial, Mix Methods	Literature Review or Scoping review article
Publication years	2018	2023
Language	English, Indonesian	Language other than English and Indonesian

The inclusion criteria used:

1. An article that discusses e-learning based on basic life support training for nurses, which is used to increase students' interest in learning basic life support
2. Articles from the research model: Quasi-experimental studies, Qualitative survey or research, Cross-sectional Survey, randomized control and trial, mixed methods.
3. Articles published in Indonesian and English from 2018 to 2023.
4. Articles published in journals that go through a peer-review process.
5. Articles with full text.

Article searches were conducted using boolean operators (AND, OR NOT, or AND NOT) to expand or specify the search, making determining the articles or journals used easier. The keywords in this literature review are adjusted to the Medical Subject Heading (MeSH) and consist of the following:

Table 2. Keyword of Literature Review

Basic Life Support	Learning Methods	Nursing	E-learning
OR	OR	OR	OR
BLS	Learn Methods	Nurse	Electronic learning
OR			
Training Basic life support			
OR			
Training BLS			

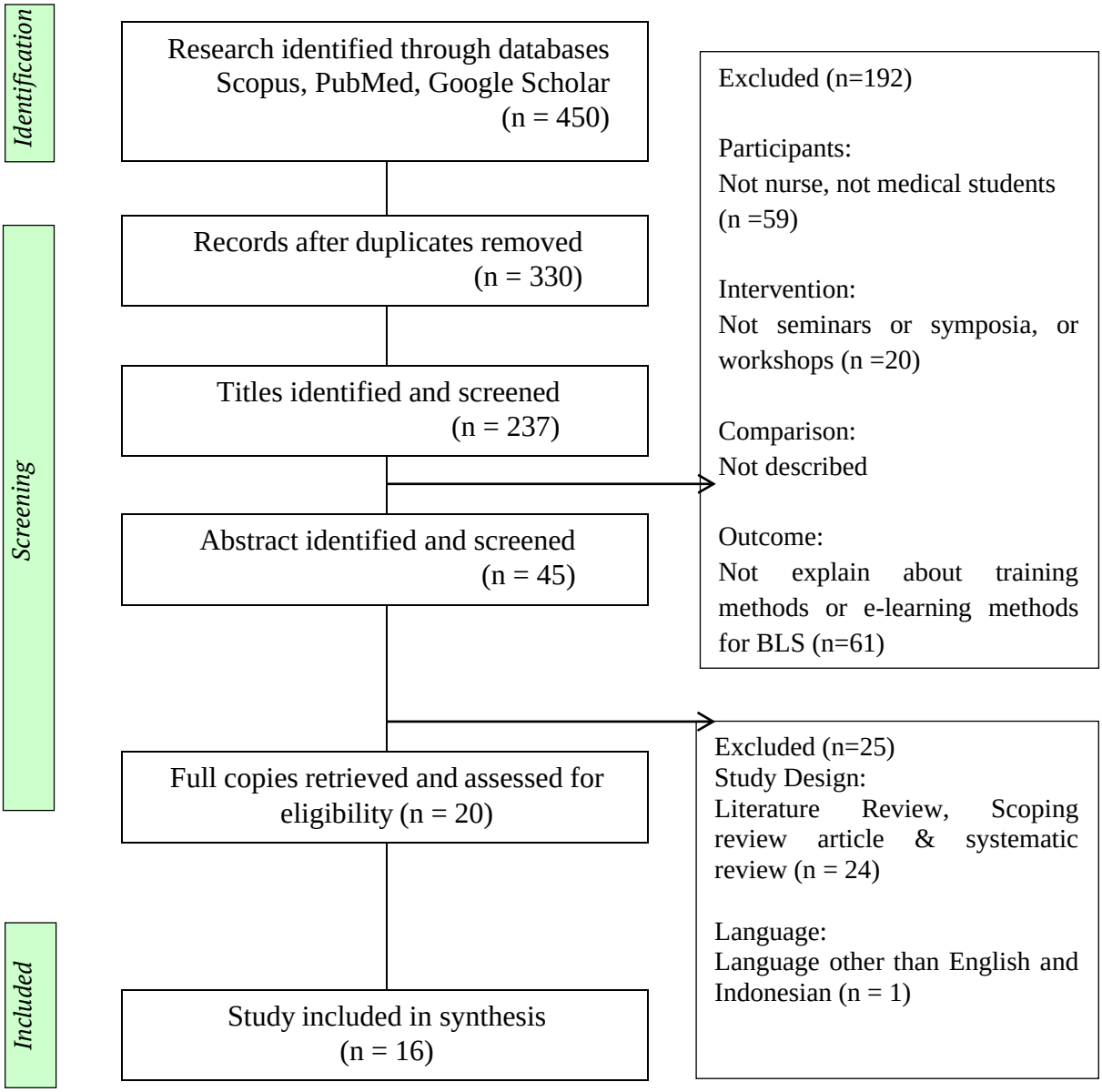

Figure 1. PRISMA Diagrams

Based on the results, a total of 450 articles matched the keywords. The search results obtained are then checked for duplication, finding that 120 articles are the same, so they are excluded, and 330 remain. The researcher then screened based on the title (n = 237); in the title, the researcher conducted a deep PICOT analysis to screen 192 articles based on the exclusion criteria. In the abstract (n = 45), screening was carried out based on study design and language and excluded 25 articles. The full text (n = 20) was adjusted to the literature review theme in the final screening stage, and 16 articles were obtained. An assessment based on the inclusion and exclusion criteria eligibility obtained 16 articles that could be used in the literature review.

The study used the CASP (Critical Appraisal Skills Programme) form for quality appraisal (CASP, 2024). The study selection in this research starts with identifying the journal articles based on inclusion and exclusion criteria, screening the journal articles, and including them. After 16 articles were selected, the researcher extracted the data from each journal, consisting of title, author, years, study, sample, variable, instrument, and analysis summary, as shown in Table 3.

3. RESULTS AND DISCUSSION

Table 3. Literature Search Result

No	Title	Authors and years	Study design, Sample, Variable, Instrument, Analysis	Summary of Results
1	Development of an Extended Reality Simulator for Basic Life Support Training	Lee et al, 2022	Design: Quantitative Sample: Sixteen experts participated Variable: BLS simulator without instructors Instrument: Learning mode & practice mode Analysis: Usability test	The Extended Reality (XR)-BLS simulator is useful and can conduct education without requiring instructors and trainees to gather

2	Dissemination of Cardiopulmonary Resuscitation Training for Nurses Treating Coronavirus Disease-2019 Patients: A Single-arm Pre-experimental Study	Joshi et al, 2022	Design: Pre-experimental study Sample: 160 nurses Variable: online study material, skill nurse Instrument: questionnaire Analysis: a paired "t" test	A well-structured, online study material can impart knowledge and demonstrate the basic and essential skills nurses require for CPR for COVID-19 patients.
3	The Impact of e-Learning Systems on Motivating Students and Enhancing Their Outcomes During COVID-19: A Mixed-Method Approach	Yahiaoui et al, 2022	Design: Mix Methods (quantitative and qualitative approaches) Sample: 400 student (snowball sample) Variable: *E-learning* systems, student motivation, student entrepreneurship Instrument: Questionnaire Analysis: -Quantitative using structural equation modeling (SEM) through IBM SPSS -Qualitative using visualization techniques analysis, cluster analysis, and cognitive mapping.	The quantitative showed : • Positive significant correlation between e-learning systems and student motivation • Positive significant relationship between student motivation and student outcomes • Students' positive attitudes towards the e-learning system outnumber negative attitudes, positively influencing student motivation and learning outcomes.
4	E-Learning Satisfaction and Barriers in Unprepared and Resource-Limited Systems During the	Taher et al, 2022	Design: Descriptive statistics Sample: 870 Students Variable: socio-demographic, *E-learning* program, students' perspectives, barriers experienced Instrument: Questionnaire	The study result showed: • Approximately 64.8% of students are dissatisfied with the experience of using E-learning • Only around 35.5% of students are taking synchronous electronic

	COVID-19 Pandemic: Descriptive statistics		Analysis: Data were analyzed using the SPSS software program version 26 released in 2019 by IBM Corp, Armonk, NY	classes while the remaining students use asynchronous learning activities • Students' level of satisfaction was poor, as only 6.4% of students strongly believed that tutoring was informative and that educational technology was adequate. • In contrast, 69% of students strongly agreed that *E-learning* saved them time and money • The student perceived the barriers were slow internet speed, power interruption, and the lack of face-to-face interaction
5	Piloting a Basic Life Support instructor course: A short report	Nabecker et al, 2022	Design: Quantitative Sample: 31 healthcare providers in 4 courses Variable: pilot shortened Basic Instructor Course Instrument: questionnaire Analysis: Chi-square	The result showed: • Participants of the pilot shortened Basic Instructor Course in a healthcare setting were successfully trained to teach the European Resuscitation Council's Basic Life Support provider courses in a short four-hour format. • The pilot course seems highly likely to allow future instructors to teach courses in the provision of Basic Life Support training.

				• Very high motivation to teach can result in four times as many instructors being able to teach the course after the pilot course compared to the standard course.
6	Medical students' perception towards E-learning during COVID 19 pandemic in a high burden developing country	Gismalla et al, 2021	Design: Descriptive cross-sectional survey Sample: 358 undergraduate medical students Variable: medical student opinion regards starting the *E-learning* Instrument: self-administered online based questionnaire Analysis: Chi-square test	E-learning as a teaching tool of medical education can offer an effective alternative to the traditional on-site education format and help solve the shortage of healthcare providers and educators.
7	A survey of E-learning methods in nursing and medical education during COVID-19 pandemic in India	Singh et al, 2021	Design: Cross-sectional survey Sample: 1541 medical and 684 students Variable: online teaching methods -> as feasible, acceptable, and effective as in-class teaching Instrument: Online questionnaire Analysis: chi-square test	The result showed: • PowerPoint presentation was the most commonly used (80%) method [medical (92.6%), nursing students (50.3%), $p < 0.0001$]. • Other methods employed were didactic lectures without any aids (22%), case-based learning (52.7%: medical-61%, nursing 33.9%, $p < 0.0001$), video-based learning (50%), interactive sessions (41%), recorded lectures (46.8%), quizzes (38.1%), virtual models using on classes (24.5%) and online whiteboard teaching using diagrams (24%).

8	Nursing students' and educators' experience with e-learning during a pandemic: An online survey	Eltaybani et al, 2021	Design: Cross-sectional design Sample: 675 participants (nursing students =580 and nursing educators = 95) Variable: Nursing students' and educators' experiences with *E-learning* during the COVID-19 pandemic and preferences for responding to online versus paper questionnaires Instrument: questionnaires (google form) Analysis: T test or the $\chi 2$ test	The current study showed: • Student's overall satisfaction and competency with e-learning were significantly lower than that of educators. Likewise, student evaluation of the overall quality of the e-learning system process is significantly lower than that of educators. This may reflect the participants' positive attitude in using e-learning as an alternative teaching approach during the COVID-19 pandemic. The perception of some students in this study was much lower than that of educators about the possibility of taking online exams.
9	Students' perception of online learning during the COVID-19 pandemic: A survey study of Polish medical students	Bączek et al, 2021	Design: Observational Study-descriptive statistics Sample: 804 participants students Variable: demographic details, advantages and disadvantages of *E-learning*, likers scale of face-to-face learning with online learning, rate the level of acceptance of online classes Instrument: Questionnaire Analysis: Chi-square, Mann–Whitney tests and the	This study showed: • *E-learning* is a valuable method of teaching medical students. • *E-learning* is effective in increasing knowledge and is highly accepted There is no statistical difference between face-to-face and online learning, which is seen from the opinion of the method's ability to increase knowledge.

			nonparametric Wilcoxon signed-rank test	
10	Lean Six Sigma Redesign of a Process for Healthcare Mandatory Education in Basic Life Support-A Pilot Study: Qualitative Study	Dempsey et al, 2021	Design: Qualitative Sample: 82 participants Variable: process accessing mandatory training (mandatory training program of Basic Life Support) Instrument: Intervention Design Analysis: : Chi-square	This study showed: • The redesign of the BLS training program resulted in a new blended delivery method • The redesign of the BLS training program increased 50% in Basic Life Support (BLS) class volume and The redesign of the BLS training program estimated savings time for about 154 hours 30 minutes for staff and 48 hours 14 minutes for instructors.
11	E-Learning perception and satisfaction among health sciences students amid the COVID-19 pandemic: Qualitative Survey Study	Abbasi et al, 2020	Design: Qualitative Survey-Questionnaire Sample: 1255 participants student Variable: experience and perception of *E-learning* among the student Instrument: Questionnaire by upload on Google survey Analysis: t-test and spearman	• The majority of participants agreed that E-learning is very satisfying in acquiring knowledge E-learning is not practical for acquiring clinical and technical skills.
12	Mastery versus self-directed blended learning in basic life support: a randomized controlled trial	Madou & Iserbyt, 2019	Design: Experimental groups Sample: 145 students Variable: Mastery learning (ML) versus a self-directed learning (SDL) -> The effect Instrument: A randomized controlled trial Analysis: Shapiro–Wilk's test	All blended learning models are very time-saving because the face-to-face component only takes about 45 minutes, and learning outcomes will follow the guidelines.

13	Animation and interactivity facilitate acquisition of pediatric life support skills	Lehmann et al, 2019	Design: prospective study Sample: 103 medical students Variable: self-instructional videos on Pediatric basic life support (PBLS), an animation-enriched VP group with VP containing interactive questions and animated media, and a static VP group with VP Instrument: Experimental and causal comparative studies Analysis: : Chi-square	• Virtual Patient (VP) can feasibly enhance PBLS skill acquisition. Thoughtful Virtual Patient (VP) animation and interactivity design can increase the acquisition of performance and compliance with temporal demands skills
14	Nursing students, knowledge, attitude, self-efficacy in blended learning of cardiopulmonary resuscitation	Moon and Hyun, 2019	Design: randomized control design Sample: 120 nursing Variable: blended learning CPR education program, knowledge, attitude, and self-efficacy Instrument: questionnaire Analysis: paired t-test	A blended learning Cardiac Pulmonary Resuscitation program (monocentric study) that integrates videos and face-to-face meetings was effective in increasing knowledge and attitudes among nursing students, particularly in Cardiac Pulmonary Resuscitation.
15	Basic life support and external defibrillation competences after instruction and at 6 months comparing face-to-face and blended training. Randomized trial	Castillo et al, 2018	Design: Experimental Sample: 129 student medicine of nursing Variable: training video, a new website, a Moodle platform, an intelligent manikin, and 45 min of instructor presence Instrument: a multi-choice questionnaire (MCQ) Analysis:	The blended method provides the same or even higher levels of knowledge and skills than standard instruction immediately after the course and six months later.
16	Self-learning basic life support: A randomized	Pedersen, 2018	Design: Experiment Sample: 152 students	• Self-learning is not inferior to facilitator-led learning in the short-

controlled trial on learning conditions	Variable: Basic Life Support self-learning without supervision or BLS teaching Instrument: randomized controlled trial Analysis: Mann-Whitney U test for non-paired data and Wilcoxon signed-rank test for paired data	term Independent learning resulted in better retention of Basic Life Support skills three months after the training compared to training led directly by the facilitator.

Based on 16 articles that have been reviewed, this study will discuss the effectiveness of e-learning, e-learning learning models, and Basic Life Support learning models.

The results showed many opinions on the effectiveness of E-learning implementation. Yahiaoui et al. (2022) explained the relationship between the e-learning system and learning motivation. This learning motivation can provide positive learning outcomes for nurses towards e-learning. Eltaybani et al. (2021) argue that students express satisfaction with e-learning on average. This is reflected in the attitude of participants who are open to using e-learning as an alternative teaching approach but not for imp rather than online examinations. Bączek et al. (2021) and Abbasi et al. (2020) explain that e-learning effectively improves learners' knowledge. A study by Baczek also compared face-to-face and online learning but found no significant difference. This finding is supported by the theory of Abbasi et al. (2020) that e-learning is not meant to improve learners' clinical skills. E-learning is usually used as an alternative to solving problems found during conventional learning, where this learning requires on-site learning, especially in healthcare facilities that will conduct learning or training and education service providers (Gismalla et al., 2021). Study by Taher et al., (2022) stated that participants are not satisfied with the experience of using e-learning. The causes are unstable internet speed and lack of face-to-face interaction between participants and presenters.Another study by Agustini, et al., (2020) about the effect of health education about emergency condition on the knowledge and ability of parents in handling children with emergency condition showed that on-site learning method (lecture method) is effective in increasing the knowledge and ability of the parents. Lecture method let the parent to have an interaction with the other parents in sharing about how to deal with emergency situation in children. In conclusion, on-site learning has a good effect on the delivery of information given by the speaker, but the existence of blended learning provides solutions in the time constraints and the variation of methods that can be used in the learning model, to provide a better learning outcome.

The learning model presented by Nabecker et al., (2022) explains that participants who used the Pilot Shortened Basic Instructor Course successfully attended the Resuscitation Council's Basic Life Support training in Europe. Implementing training with this program will take about 4 hours faster than the usual learning model. A study by Singh et al., (2021) also explained the results of their study that the best learning methods are (1) PowerPoint, (2) video-based learning, (3) interactive sessions, (4) recorded lectures, (5) quizzes, (6)virtual models, (7) whiteboard teaching. This theory is supported by the opinion of Madou & Iserbyt (2019), who states that the blended learning

model significantly saves training time compared to face-to-face learning.

BLS training is the primary training to save patients from respiratory and cardiac arrest (American Heart Association, 2020). The emergency care competencies of nurses in BLS can be improve through continous education and training (Sanjana, 2023). According to Moon and Hyun (2019), who discussed the implementation of blended training, this training model combines several existing training models. In this article, blended training combines video and face-to-face learning. This combined training improved the knowledge and attitudes of cardiopulmonary resuscitation (CPR) trainees (Puspa, et al., 2023; Alsoufi, et al., 2020). Another researcher who took the topic of blended methods is Castillo et al. (2018), who mentioned that blended methods can improve the knowledge and skills of learners both immediately after training and six months later (long term).

Research by Dempsey et al. (2021) states that blended methods design can increase the volume of BLS classes. The increase in BLS training classes aligns with the increase in participants' interest in learning. Demsey also claimed that this blended methods design can save training time. Meanwhile, Pedersen (2018) explains that self-learning BLS can increase the memory of the material learned compared to using facilitator-led learning. The learning model is expected to be well structured because structured online studies can provide knowledge and demonstrate basic and critical skills for nurses in performing cardiopulmonary resuscitation (CPR) (Joshi et al., 2022).

Several researchers have made innovations in developing supporting tools for conducting training, especially BLS training. A study by Lee (2022) stated that the Extended Reality (XR) as a BLS simulator is very helpful for BLS training without a trainer. XR is a simulator that combines the virtual and real world. This XR simulator must use virtual reality (VR). VR is a device that allows users to see what the world is like, like seeing the natural world. Also, it allows them to interact in cyberspace, such as conducting cardiopulmonary resuscitation (CPR) training with fictitious patients, in line with the study by Lehmann et al., (2019), who conducted research on virtual patient (VP) in pediatric essential life support (PBLS) training. VP is a form of e-learning development that designs an application that inputs several conditions and clinical criteria of the patient, just like the patient's condition experiencing the disease in real-time. So, in their research, Lehmann et al., (2019) argue that this VP can improve the skills of PBLS training.

From the reviewed articles, almost all participants said they were satisfied with implementing the E-learning learning model. E-learning has a positive correlation with:

1. Motivation
2. Knowledge
3. Learning Alternative

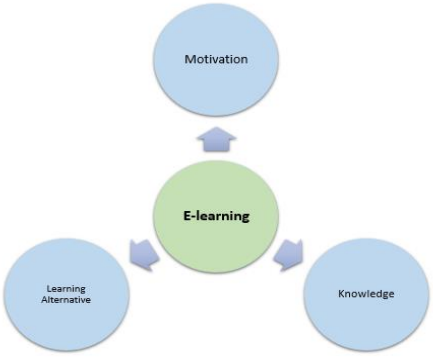

Figure 2. Correlation of E-learning

In addition to increasing motivation and knowledge, e-learning can be an alternative when students face difficulties in implementing face-to-face learning because of the distance between learners and material providers who are not in a place or time and limited direct learning space. The flexible principle in e-learning has been discussed in the E-learning Concepts and Applications book (2014), where e-learning refers to delivering learning materials to anyone, anywhere, and anytime by using various technologies in an open, flexible, and distributed learning environment. Furthermore, open and flexible learning refers to learners' freedom in terms of time, place, pace, content, learning style, type of evaluation, and collaborative or independent learning.

The number of learning models obtained from journal discussions in the search for excellent outcomes causes the need for grouping, which makes it easier for researchers to develop learning models. Picciano et al., (2022) explain that Blended Learning is a combination and match between face-to-face training and online training, which will be arranged according to the learning needs designed.

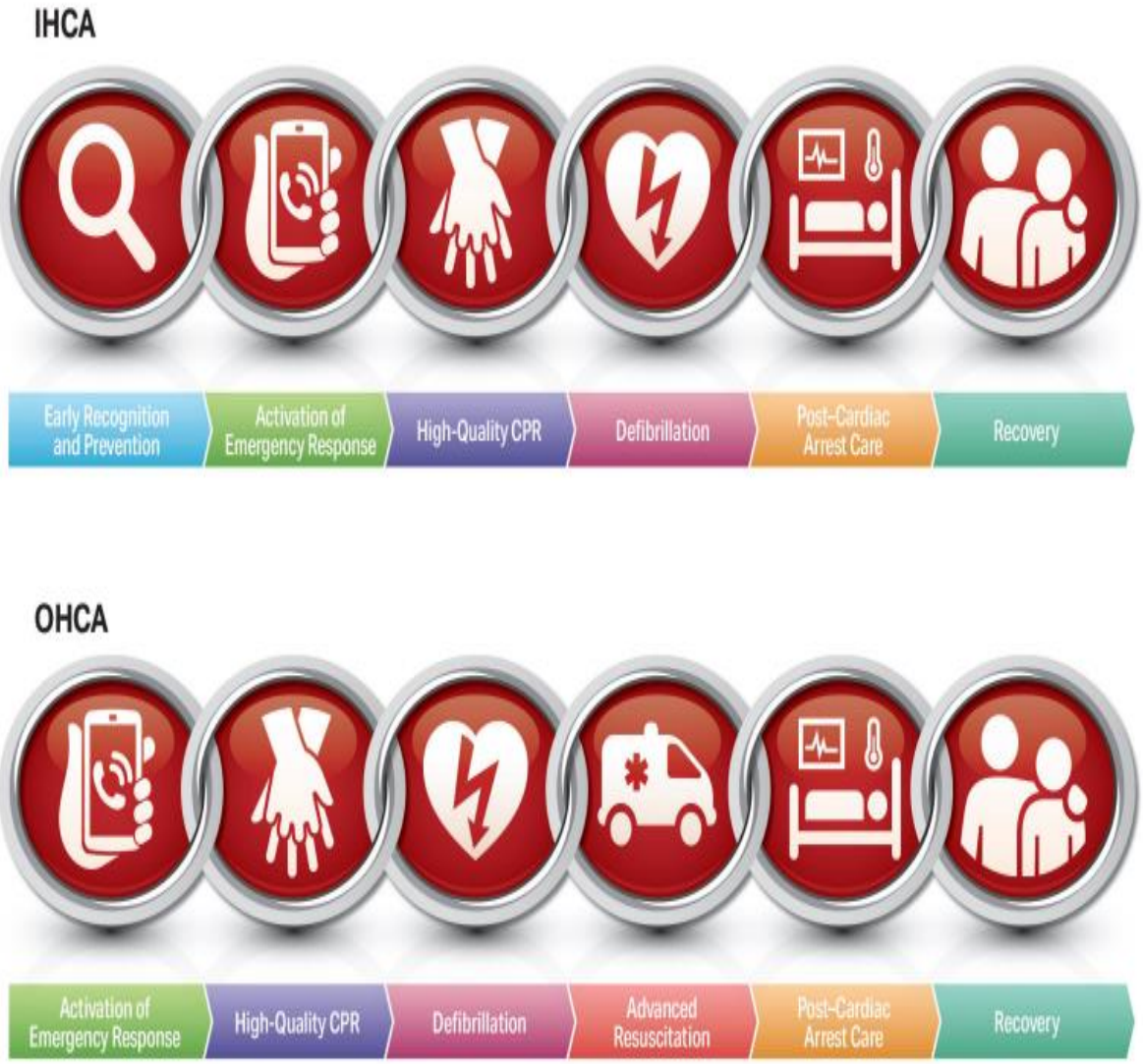

Figure 3. AHA Chains of Survival for Adult IHCA and OHCA

According to American Heart Association, (2020), Chains of Survival is an organized method so learners can easily understand what is involved in saving human life. It is necessary to distribute the material made with this structure based on the results of the articles reviewed using Blended Learning. Blended learning combines conventional learning (face-to-face) with learning that utilizes information and communication technology (Nasution & Jalinus, 2019s). Recommendations for grouping material based on the BLS American Heart Association, (2020) can use learning methods classified according to J.R David in the book "Learning Strategies (2019)" where the learning method here can be interpreted as a method used to implement plans that have been prepared in the form of fundamental and practical activities to achieve learning objectives. Several learning methods can be used to implement learning strategies, including: (1) lecture; (2) demonstration; (3) discussion; (4) simulation; (5) laboratory; (6) field experience; (7) brainstorming; (8) debate, (9) symposium. The composition of the blended learning model that wants to be applied to BLS learning is 50/50%, meaning that the time allocation provided 50% for face-to-face activities and 50% for online learning activities (Nasution & Jalinus, 2019). The consideration of using this 50/50% blended learning composition is to provide learning results that are more effective, efficient, and interesting and improve understanding of material and skill.

Figure 5. Blended Learning Model

4. CONCLUSION

From the discussion above, the learning model that can be recommended in learning Basic Life Support nurses based on e-learning is the Blended Learning model, where the learning model by combining face-to-face learning and online learning (e-learning) is proven effective in improving students' knowledge and skills.

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