Apps "SIPITUNG": Flipped-classroom training in basic cardiopulmonary life support

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A B S T R A C T

Background: The high number of Out of Hospital Cardiac Arrest (OHCA) worldwide, and Indonesia is not followed by high life expectancy and bystander. The role of bystander influences the high life expectancy on OHCA. The flipped learning method can increase knowledge and skills and the success of flipped learning.

Objective: This study aimed to develop and test Aplikasi Hadapi Henti Jantung (Sipitung) app on the flipped classroom method in learning Basic Life Support more effectively to increase knowledge, skills, and self-efficacy.

Method: The design of this research was Research and Development (R&D). This design consisted of 3 stages; stage I (literature study), stage II (application development), and stage III (application trial).

Results: Based on the results of the literature review conducted following the American Heart Association guidelines on cardiac arrest, basic life support on adults required learning media that combines text, video, and audio. 4 features were included in developing and creating applications. In the experimental process, the researchers compared learning methods using flipped classroom with simulations in increasing knowledge, skills, and self-efficacy.

Conclusion: "SIPITUNG" application in the flipped classroom method was an effective basic life support learning medium to improve knowledge, skills, and self-efficacy.

INTRODUCTION

One serious health problem nowadays is Out of Hospital Cardiac Arrest (OHCA) due to high prevalence rates and low survival rates. The prevalence of OHCA on a global scale occurs at 50-60 per 100,000 individuals.[1] A study conducted by The Pan Asian Resuscitation Outcome Study found that 66,780 cases of OHCA survival rate until hospital discharge were from zero survivors to 31.2% survival rate. The rate of cardiac arrest in Indonesia has predicted as many as 300,000-350,000 cases. It is estimated to occur in 10 out of 100,000 people who have no other heart disease, there is no survival rate data.[2] The implementation of 3 leading chains of survival, early recognition of cardiac arrest, early CPR, and early defibrillation, is proven to increase life expectancy in cardiac arrest.[3–6]

Neurological damage is persistently unavoidable when resuscitation is carried out by Emergency Medical Services. The role of bystanders in recognizing cardiac arrest and providing quality resuscitation affects life expectancy and the occurrence of neurological damage.[5,7–9] he importance of a bystander's role is compared to ordinary people's willingness to become bystanders.[10,11] The general public's low willingness to conduct resuscitation due to the lack of learning received the fear of worsening the victim's condition, fear of constricting infection, and inability to provide adequate resuscitation.[12,13] The effort to increase the willingness to become a bystander is by providing Pulmonary Resuscitation (CPR) training by using a brief video to provide training to raise awareness and disseminate resuscitation knowledge and conduct training in schools and improve the quality of CPR assisted by dispatchers.[14,15]

There are several methods in providing Basic Life Support (BLS) learning. Simulation is a standard method of providing basic life support learning. The simulation method provides an advantage with the presence of instructors to provide direct learning.[16] Simulation has a disadvantage in which the students are relatively passive because only instructors who are active in the learning process.[17] The flipped classroom is a transition method from pedagogical learning to self-directed learning. Flipped classroom method is a method that reverses learning by providing learning material and questions in the beginning and then followed by discussion in the next meeting, in-depth learning, and practice if necessary.[18–20] Not all flipped learning methods can improve knowledge and skills, situations and media affect the accomplishment of learning flipped learning.[21]

The flipped learning method can use technology-based learning media that combine text, video, audio, without the time and place restrictions.[18]. CPR learning using flipped classroom has been proven to improve knowledge and skills and can use smartphone applications as learning media.[22,23] The use of applications on smartphones in BLS training can be easily accessible; the application can provide training by providing scenarios by real incidents.[24] Some studies utilize the application as a CPR learning media. This application contains material and videos that focus on hand-only CPR.[25] This study demonstrated that the groups that only use applications have lower skills compared to the groups that acquire direct learning. The learning provision should provide the use of AED since the bystander's role is in the three leading chains of a chain of survival.[26] Systematic review and meta-analysis illustrate that video footage in a proper application can provide a real scenario of events and has a metronome so that the quality of CPR provision can be fulfilled.[24]

Therefore, this study aimed to develop and test the application of *Aplikasi Hadapi Henti Jantung* (Sipitung) app in the flipped classroom method on Basic Life Support learning more effectively to increase knowledge, skills, and self-efficacy.

METHOD

This research design is Research and Development (R&D) consisted of 3 stages; stage I (literature study), stage II (application development), and stage III (application trial).[27]

Research Phase I

At this stage, the researchers conducted a literature review related to constructing material on a practical and easy-to-use basic life support.

Research Phase II

This stage was the stage of application assembly and development. Easily recognizable features and in compliance with learning objectives were created. There were four features in this smartphone application. Feature 1 contained; material for cardiac arrest (understanding, causes, signs, and symptoms), CPR (understanding, technique and timing of CPR, and breathing assistance), AED (Definition and function of CPR). Feature 2 contained a video demonstration of BLS for cardiac arrest on adults with two helpers with existing and without AED scenarios. Feature 3 was a question exercise with ten multiple-choice questions about BLS for cardiac arrest on adults. Feature 4 was a practical exercise that contains audio instructions for BLS guidelines equipped with timing counter so that the total time spent in conducting BLS could be acquired, and was equipped with a metronome with a speed of 110 times/minute during the CPR section.

Research Phase III

This stage was the trial or experimental phase.[28] The flipped classroom learning method that used a smartphone application was compared to the simulation method that uses leaflet media. The sample used was 110 junior high school students.[29] This study took a sample of junior high school students to assess the effectiveness of the application. The lowest learning for BLS was in junior high school students. If junior high school students were able to understand and operate this application, then it will be applicable for the higher level of high school students and college students.[30] The experiment was conducted in February-March 2020 at SMPN 1 Lawang and SMPN 1 Singosari on students aged 13-14 years.

The assessment was done by asking respondents to do a pre-test questionnaire for the knowledge variable, self-efficacy, and to perform the BLS stage skills assessed with an observation sheet. After the pre-test was carried out, it was continued by providing Smartphone application media to respondents in the flipped classroom group and leaflet media in the simulation group. After one week, the second meeting began with a question and answer discussion related to the material given, demonstration by the instructor, respondents' independent practice using mannequins and media guides that had been given, and continued post-test assessment of the knowledge, self-efficacy, and skills. Flipped classroom and simulation groups received the same treatment at the second meeting. The data concerning knowledge, skills, and self-efficacy were tested using the Mann Whitney Test.

RESULTS

Literature Review Results

The principle of providing life support learning for primary cardiac arrest is consistent.[31] Providing learning by using a video may prevent heterogeneous information from instructors.[26] Learning material and videos in the application are developed based on the American Heart Associations of Basic Life Support guidelines 2015.[32]

Application Development Results

In developing and constructing an application, four features are created that can be applied to the android system (Figure 1). Results Process Feature 1: material when opening this feature, the user will get material about cardiac arrest in which there is a definition of cardiac arrest, causes and signs of symptoms, material about Cardiac Resuscitation (CPR) in which there is a definition, chest compression, and reasons of chest compression can be stopped and breathing assistance, as well as material about the AED which contains an explanation of the function and place of the AED available, Feature 2 Practice videos, when the user uses this feature, are two videos available namely hands-only CPR video with AED and without AED. Feature 3 Exercise questions, this feature contains a multiple-choice question about BLS and Feature 4 is Practice training which contains an audio com-

mand containing six BLS stages that are environmental safety assessment, awareness assessment, activation of the emergency system, chest compression guide equipped with a metronome, and AED activation if available. Practical training accompanied by live simulations by students with the instructor's guide. This application runs sequentially; users will be able to access the feature two videos if the material has been read and the next feature. The application can run on the Android system, and is downloaded at the following link: https://drive.google.com/file/d/1kBgcB7QHh8QBVdQXqDEIGMgQfEBCwV4B/view?usp=sharing

Trial Results

This study involved 110 respondents (55 people in each group). All respondents followed the study from the beginning to the end. The main characteristics of respondents in this study, the majority were female (67.3%) and 14 years old (58.2%). Learning using the flipped classroom method and simulation supports the improvement of knowledge, skills, and self-efficacy, as indicated by the increase in the average and Wilcoxon statistical tests that illustrate significant differences ($p < 0.05$). Flipped classroom learning can improve knowledge, skills and self-efficacy better compared to the simulation method, as evidenced by the higher average difference and the results of the Mann Whitney Statistical Test, which is significant with ($p < 0.05$) (Table 1).
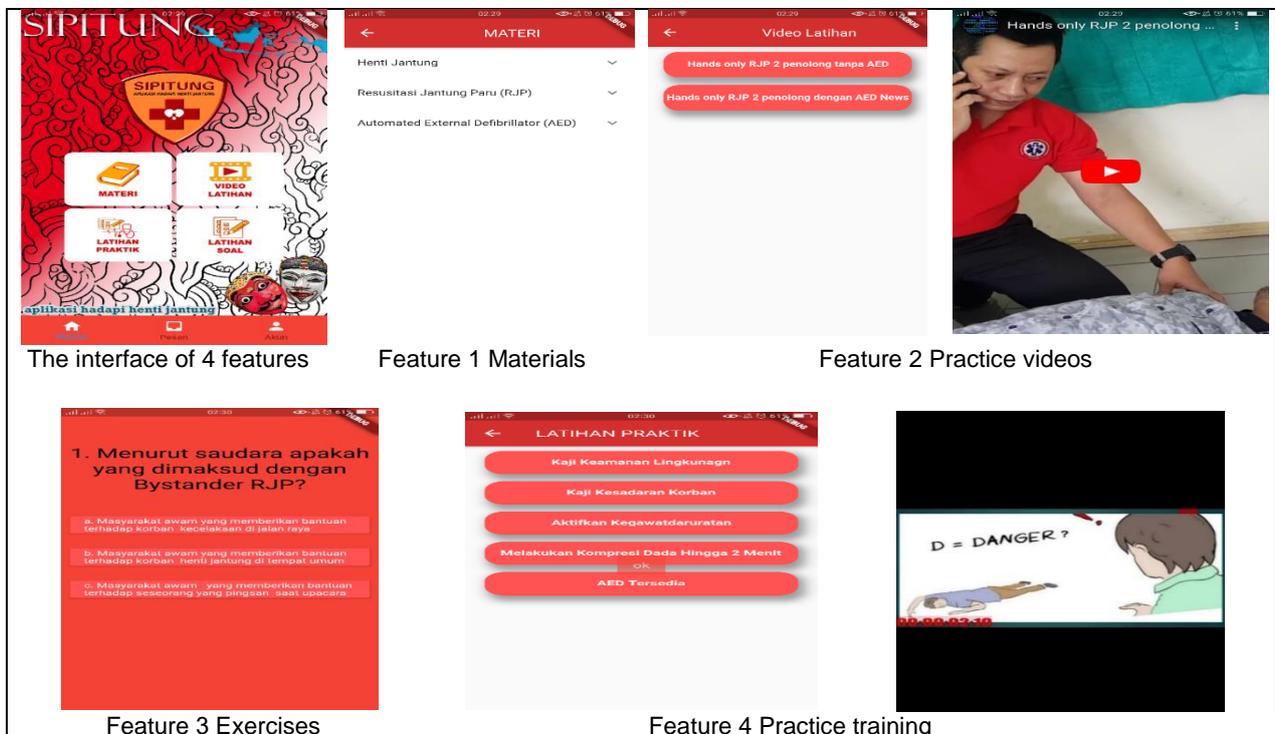

The interface of 4 features Feature 1 Materials Feature 2 Practice videos

Feature 3 Exercises Feature 4 Practice training

Figure 1. Feature of Apps "SIPITUNG"

Table 1. Differences in improvement on knowledge, skills, and self-efficacy between flipped learning and simulation only

Variable	Group	Flipped learning (n=55) Mean±SD	Simulation only (n=55) Mean±SD	Mean diff	p-value
Knowledge	Pre-test	71.90±8.86	68.45±9.71	23.09±9.27	0.017
	Post-test	95.0±4.30	86.63±8.66	18.18±10.24	
Skill	Pre-test	59.05±10.4	62.70±9.04	8.27±0.82	0.001
	Post-test	76.62±9.0	73.31±6.78	7.84±1.74	
Self-efficacy	Pre-test	59.05±10.4	62.70±9.04	17.56±9.45	0.001
	Post-test	76.62±9.0	73.31±6.78	10.62±9.37	

DISCUSSION

The statistical test results from the data prior and post-learning of basic life support knowledge of respondents in the two groups prove a significant increase. This explains that changing the class method can also help improve knowledge, self-efficacy, and BLS skills of junior high school students. Based on the difference test, flipped classroom and the simulation method obtained significantly different results between both methods where the flipped classroom group average difference showed a higher number than the simulation method. The BLS given to junior high school students by flipped classroom methods is better in improving knowledge than simulation methods.

This study's results are following other studies by comparing the improvement in ACLS knowledge and skills with flipped classroom learning methods compared to lecturer-based method.[33] Other studies also found that smartphone application usage in resuscitation learning can improve knowledge, skill, and attitude compared to the simulation method.[25] The flipped classroom learning method is an effort to combine teacher-centered learning and student-centered learning. The principle of self-learning becomes an advantage in the flipped classroom method and will further lead to active learning wherein a learning process; respondents tend to give positive responses to a new and exciting method of education. Students can do independent learning outside the class.[34]

The learning process that utilizes a Smartphone application will affect students. One of the benefits is the effect of this technology. It can increase the activation of the frontal and parietal cortex to stimulate students' cognitive and memory compared to learning by text only so that it improves long-term memory.[24] The advantage of learning with Smartphone application is that it is independent and practical (time effective & cost-effective). Learning with Smartphone applications can be done independently without the limit of time and place, and it is also repetitive as long as the device is supportive.[35]

CONCLUSIONS AND RECOMMENDATION

"SIPITUNG" application in the flipped classroom method is a practical BLS learning to improve knowledge, skills, and self-efficacy. The dissemination of knowledge on cardiac arrest BLS is essential. It is advised that the field of education utilizes Smartphone media applications to provide BLS learning.

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