The Effectiveness of the SIAPP Digital Learning Platform in Improving Community Self-Efficacy in Providing Basic Life Support in Pontianak City, Indonesia

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Abstract

Out-of-hospital cardiac arrest (OHCA) remains a major public health challenge globally, with low survival rates largely attributed to delayed or inadequate Basic Life Support (BLS) provided by lay responders. Limited access to educational resources and low self-efficacy among community members further hinder effective early intervention. This study aimed to evaluate the effectiveness of the First Aid Learning Administration Information System (SIAPP) in improving community self-efficacy in providing BLS in Pontianak City, Indonesia. A quasi-experimental study using a one-group pretest–posttest design was conducted among 33 community participants recruited through convenience sampling. The study, including the intervention and outcome assessments, was conducted over 2 weeks. The intervention consisted of SIAPP-based first-aid training. Self-efficacy was measured using a structured questionnaire before and after the intervention. Data were analyzed using the Wilcoxon signed-rank test to determine differences in self-efficacy scores. Participants' self-efficacy improved significantly after the intervention (p = 0.001). The findings indicate that SIAPP effectively increases community members' confidence in performing BLS procedures. SIAPP is an effective and scalable digital learning platform for improving community self-efficacy in BLS provision. Its implementation may strengthen early response capacity in OHCA cases and improve community-based emergency preparedness

Keywords: SIAPP, Self-efficacy, Basic Life Support, Out-of-Hospital Cardiac Arrest, Health Education

INTRODUCTION

Out-of-hospital cardiac arrest (OHCA) is a critical public health problem, often initiated by primary cardiac events that may represent the first clinical manifestation of heart disease (Memenga and Sinning 2024). Although OHCA can occur at any age, it predominantly affects older adults, with a mean age in the mid-sixties. OHCA is a time-critical medical emergency. In the absence of immediate intervention, particularly early cardiopulmonary resuscitation and defibrillation, survival decreases dramatically within minutes, and death is highly likely (Greif et al. 2024). However, timely and coordinated responses can significantly improve survival outcomes. In regions with well-established emergency medical services (EMS), overall survival rates can reach approximately 20%, while survival in ventricular fibrillation cases may exceed 50% (Nolan et al. 2020).

Globally, the incidence of OHCA ranges from 20 to 55 cases per 100,000 population annually, with survival rates averaging only 5–20%, depending largely on the timeliness and effectiveness of intervention (Held et al. 2022; Yan et al. 2020b). A meta-analysis of 141 studies involving more than 4.6 million OHCA patients reported a return of spontaneous circulation (ROSC) rate of 29.7% and an overall survival rate of approximately 9%, with significant regional variation (Yan et al. 2020a). Notably, Southeast Asia demonstrated one of the lowest ROSC rates at around 22.1% (Yan et al. 2020a). In Indonesia, the burden of cardiovascular disease remains substantial, with 877,531 recorded cases (Kemenkes RI 2023). Furthermore, the Institute for Health Metrics and Evaluation (IHME) reported an increase in heart disease-related mortality to 251.09 deaths per 100,000 population in 2023, up from 247.99 in the previous year (IHME 2024). In West Kalimantan alone, 17,713 cases of heart disease have been documented (Kemenkes RI 2023).

The high incidence of OHCA necessitates rapid and appropriate intervention. However, the average response time of professional healthcare providers following emergency calls exceeds six minutes, highlighting the urgent need for immediate resuscitation efforts by bystanders (Perkins et al. 2017). Evidence suggests that victims are nearly twice as likely to survive when cardiopulmonary resuscitation (CPR) is initiated promptly by laypersons before the arrival of emergency services (Naim et al. 2017). Despite this, global rates of bystander CPR remain low, ranging from only 35% to 45% (Virani et al. 2020).

Efforts to prepare laypersons to provide first aid in cardiac arrest situations require not only knowledge but also the ability to recognize symptoms, activate emergency response systems, and perform CPR effectively (Dainty et al. 2022). One key strategy is the promotion of health education to increase the number of trained lay rescuers within the community (Graham, McCoy, and Schultz 2015). In this context, digital health innovations offer promising opportunities to enhance the accessibility and scalability of first aid education.

The First Aid Learning Administration Information System, SIAPP (Sistem Informasi dan Administrasi Pembelajaran Penolong Pertama), was developed as an innovative digital platform to improve access to and quality of Basic Life Support (BLS) education. This system integrates multifaceted learning components, including leaflets, educational videos on cardiac arrest management, and an interactive online game known as CAMAT (Cepat Tepat Selamat), supported by an evaluation system to assess learning outcomes (Hidayat et al. 2024; Hidayat, Hatmalyakin, and Alfikrie 2023). Previous studies conducted in Pontianak demonstrated that SIAPP significantly improved participants' knowledge (Hidayat et al., 2025).

However, effective learning outcomes should encompass three key domains: knowledge, skills, and emotional aspects—particularly self-efficacy (Minna, Leena, and Tommi 2022a). This highlights a critical gap between knowledge acquisition and confidence in practical application. Other studies have shown that smartphone-based CPR applications can improve knowledge and skills after two months of intervention compared to control groups, although they do not eliminate the need for formal training (Ahmad et al. 2024).

Self-efficacy refers to an individual's belief in their capability to perform specific actions in particular situations. This construct is crucial in emergency response, as delays or failure to initiate CPR can reduce survival chances by up to 10% for every minute without intervention (Nolan et al. 2020). Low self-efficacy among community members remains a significant barrier to effective bystander intervention during OHCA, as individuals with lower confidence in their ability to perform CPR are less likely to initiate lifesaving actions (Mohd Hashim, Daud, and Mohammed Nawi 2025). Preliminary findings from interviews with 10 community members in Pontianak revealed that many individuals lack confidence, panic easily in emergencies, and doubt their ability to provide assistance. Additionally, interviews with the Pontianak City Health Office indicated that no formal public education programs on BLS for cardiac arrest cases have been implemented. A meta-analysis further suggests that technology-based CPR training is effective in improving knowledge and skills, particularly when combined with hands-on practice and instructor guidance in a blended learning approach. This approach is highly relevant for enhancing community self-efficacy through platforms such as SIAPP (Lim et al. 2022).

Unlike traditional BLS training, this study evaluates a self-paced digital ecosystem (SIAPP) specifically designed for the socio-digital context of an Indonesian urban center. While previous studies have primarily focused on improving knowledge and technical skills related to first aid and emergency response, limited attention has been given to self-efficacy as a psychological factor influencing an individual's willingness and confidence to act during emergencies.

Based on the above considerations, this study aims to evaluate the effectiveness of the First Aid Learning Administration Information System SIAPP in improving community self-efficacy in emergency response situations. The findings are expected to provide evidence for policymakers and healthcare educators regarding the use of digital health education systems to strengthen community preparedness and to contribute to the growing body of knowledge on the role of information technology in promoting self-efficacy and emergency readiness.

METHODS

This study employed a quantitative approach using a quasi-experimental design with a one-group pretest–posttest format. The study population comprised community members in Pontianak City, and 33 participants were recruited according to predefined inclusion criteria. Participants were eligible if they resided in Pontianak City, were able to understand the Indonesian language, had access to a smartphone or a device capable of supporting the SIAPP application, had no prior training in first aid for cardiac arrest, had no functional impairments that could hinder participation in the learning process, and were within the age range of adolescence to late adulthood. The study was conducted from February to December 2025.

Data collection was conducted using the Basic Life Support Self-Efficacy Questionnaire (BLS-SE), a researcher-developed instrument designed to assess community self-efficacy in performing BLS during cardiac arrest emergencies. The questionnaire was integrated into the SIAPP platform and administered online. The instrument consisted of 10 items covering participants' confidence in recognizing cardiac arrest, assessing airway, breathing, and circulation, remaining calm during emergencies, performing chest compressions according to BLS guidelines, seeking assistance, and identifying signs of return of life. Responses were measured using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), resulting in a total score range of 10–50, with higher scores indicating greater self-efficacy. Prior to implementation, the questionnaire underwent content validation by experts in emergency nursing and health education. Reliability testing demonstrated good internal consistency, with a Cronbach's alpha coefficient of 0.891, indicating acceptable reliability for measuring self-efficacy among community members.

. Data were analyzed using IBM SPSS Statistics version 26. Descriptive (univariate) analysis was performed to summarize participant characteristics using frequencies and percentages. Prior to inferential analysis, data normality was assessed using the Shapiro–Wilk test. The results indicated that the self-efficacy scores were not normally distributed; therefore, the non-parametric Wilcoxon signed-rank test was used to determine differences in self-efficacy scores before and after the intervention. Ethical approval for this study was obtained from the Ethics Committee of STIKes YARSI Pontianak (No. 092/KEPK/STIKes.YSI/IX/2025), ensuring that all research procedures adhered to ethical standards for the conduct of research involving human participants.

RESULTS

Table 1. Characteristics of Respondents (n=33)

Variable	Category	Frequency	Percentage (%)
Gender	Male	14	42.4
	Female	19	57.6
Residence Are	Pontianak Kota Subdistrict	5	15.2
	East Pontianak Subdistrict	7	21.2
	West Pontianak Subdistrict	8	24.2
	North Pontianak Subdistrict	5	15.2
	South Pontianak	3	9.0
	South East Pontianak Subdistrict	5	15.2
Education Level	High School or Equivalent	14	42.4
	Higher Education	19	57.6
Occupation	Student	8	24.2
	Civil Servant / Military / Police	6	18.2
	Private Sector	13	39.4
	Homemaker	6	18.2

Based on Table 1, the majority of respondents were female (57.6%). Participants were recruited using convenience sampling from all six administrative districts of Pontianak City, with the highest proportion residing in west Pontianak (24.2%). Most respondents had attained higher education (57.6%), and the largest occupational group was private-sector employees (39.4%). These findings indicate that the study sample was predominantly female, highly educated, and employed in the private sector.

Table 2. Distribution of Respondents Based on Self-Efficacy Before and After the Intervention (n=33)

Self-Efficacy Level	Pre-test		Post-test	
	n	%	n	%
Low	21	63.6	15	45.5
Moderate	12	36.4	12	36.4
High	0	0.0	6	18.2
Total	33	100	33	100

As shown in Table 2, before the intervention, the majority of respondents (63.6%) demonstrated low self-efficacy, and none were categorized as having high self-efficacy. Following the SIAPP-based learning intervention, respondents showed an improvement in self-efficacy levels. The proportion of participants with low self-efficacy decreased from 63.6% to 45.5%, while the proportion of those with high self-efficacy increased to 18.2%.

Table 3. Wilcoxon Signed-Rank Test Results (n=33)

Comparison Category	n	Mean Rank	Sum of Rank	Z	p-value	Effect Size (r)
Negative Ranks	0	0.00	0.00			
Positive Ranks	11	6.00	66.00	-3.207	0.001	0.558
Ties	22					

The Wilcoxon signed-rank test demonstrated a statistically significant increase in self-efficacy following the SIAPP intervention (Z = -3.207, p = 0.001). The calculated effect size was 0.558, indicating a large intervention effect according to Cohen's criteria. These findings suggest that SIAPP had a substantial positive impact on participants' confidence in performing

DISCUSSION

The demographic characteristics of the respondents provide important context for interpreting the study findings. Most participants were female (57.6%), had attained higher education (57.6%), and were employed in the private sector (39.4%). In addition, participants were recruited from all six administrative districts of Pontianak City, ensuring geographical diversity within the sample. Previous research indicates that education level, age, and digital experience influence learning outcomes in digital environments and may affect responsiveness to technology-based interventions (Wetsch et al. 2024). Individuals with higher educational attainment generally demonstrate better health literacy and greater familiarity with digital learning platforms, which may facilitate engagement with educational applications such as SIAPP. Similarly, younger and more educated participants have been shown to respond more positively to digital training in terms of both learning outcomes and self-efficacy improvements (Abuejheisheh et al. 2023).

The present study demonstrated a statistically significant improvement in self-efficacy following the SIAPP intervention. The Wilcoxon signed-rank test revealed a significant difference between pre- and post-intervention scores (p = 0.001), indicating that participants experienced meaningful improvements in their confidence to provide first aid for cardiac arrest. Furthermore, the calculated effect size (r = 0.558) indicated a large intervention effect, suggesting that the observed improvement was not only statistically significant but also practically meaningful. The absence of negative ranks and the presence of positive ranks among respondents further support the effectiveness of SIAPP in strengthening self-efficacy. In addition, the observed shift from lower self-efficacy categories to moderate and high categories following the intervention demonstrates that the application successfully enhanced participants' confidence in responding to emergency situations. These findings are consistent

with the literature emphasizing the importance of psychological factors in first aid training, as self-efficacy plays a crucial role in determining an individual's readiness to act during emergencies (Minna, Leena, and Tommi 2022b).

The increase in self-efficacy following the SIAPP intervention aligns with previous studies demonstrating that technology-based training and distance learning can enhance participants' perceived competence. Such improvements in confidence are not solely derived from hands-on practice but also from exposure to structured and accessible learning materials delivered through digital platforms (Reavley et al. 2021). Previous research has shown that self-efficacy in first aid can be effectively improved through well-designed educational interventions, including remote learning approaches. Furthermore, the literature supports that self-efficacy can be validly measured using standardized instruments across different populations, reinforcing that the improvements observed in this study reflect genuine psychological changes rather than measurement artifacts (D'Angelo et al. 2023).

The effectiveness of SIAPP may be explained by several learning mechanisms embedded within the application. First, the use of visual learning materials facilitates understanding of cardiac arrest recognition and first aid procedures. Second, unrestricted access to learning content allows participants to review educational materials repeatedly, thereby improving retention and reinforcing confidence. Third, the modular and structured presentation of first aid procedures enables users to learn complex skills through manageable steps. According to Social Cognitive Theory, mastery experiences represent the most influential source of self-efficacy. Therefore, repeated exposure to educational content and increased familiarity with emergency response procedures may have contributed to the significant improvement in self-efficacy observed in this study (D'Angelo et al. 2023).

The findings are also consistent with previous research on SIAPP, which demonstrated its effectiveness in improving community knowledge regarding first aid for cardiac arrest (Hidayat, Alfikrie, and Hatmalyakin 2025). Although that study primarily focused on knowledge outcomes, the present findings suggest that the benefits of SIAPP extend beyond cognitive improvement and include enhancement of psychological readiness. Knowledge is widely recognized as a prerequisite for self-efficacy because individuals who understand what actions should be taken during emergencies are generally more confident in performing those actions. Therefore, the structured, modular, and repeatedly accessible content provided by SIAPP may have simultaneously strengthened both knowledge acquisition and self-efficacy.

From a behavioral perspective, these findings are consistent with the Capability Opportunity Motivation–Behavior (COM-B) model, which proposes that behavioral

performance is influenced by an individual's capability, opportunity, and motivation (Michie, van Stralen, and West 2011). SIAPP contributes to improving psychological capability by providing clear and accessible knowledge regarding cardiac arrest recognition and first aid procedures. Increased self-efficacy may also strengthen motivation to act, thereby increasing the likelihood that individuals will intervene during emergency situations. Consequently, participants who completed the SIAPP program may be better prepared and more willing to provide assistance when witnessing an out-of-hospital cardiac arrest event.

From a practical standpoint, the findings suggest that SIAPP can be integrated into community-based health promotion and BLS education programs as a digital learning tool to enhance individuals' confidence in recognizing cardiac arrest, activating emergency medical services, and initiating CPR before professional medical assistance arrives. Wider implementation of SIAPP may increase bystander involvement and strengthen community preparedness in responding to OHCA emergencies. However, the long-term effectiveness of the intervention requires further investigation through more robust study designs, such as quasi-experimental studies with control groups or randomized controlled trials (RCTs), as well as assessments of self-efficacy retention over time. Previous longitudinal studies indicate that the effects of digital training may decline without reinforcement; therefore, incorporating reminders, simulation scenarios, and advanced training modules may help sustain the benefits of SIAPP over the long term (Reavley et al. 2021).

Overall, the findings indicate that SIAPP is an effective digital educational platform for improving self-efficacy in first aid for cardiac arrest. The significant improvement observed following the intervention, combined with the large effect size, supports the potential of SIAPP as a scalable community-based educational strategy. With further development, including interactive simulations, objective performance evaluation, and long-term reinforcement strategies, SIAPP has the potential to strengthen community preparedness and improve bystander response to cardiac arrest at the population level.

Limitation

This study has several limitations. First, the relatively small sample size (n = 33) may limit the generalizability of the findings and, therefore, should be considered preliminary evidence. Second, the use of a one-group pretest–posttest design without a control group restricts the ability to establish causal relationships between the intervention and the observed improvements in self-efficacy. Third, self-efficacy was measured using a self-reported questionnaire, which may be subject to social desirability bias. Future studies should involve

larger and more diverse populations, incorporate control groups or randomized designs, and evaluate the long-term retention of self-efficacy and BLS performance.

CONCLUSIONS

This study demonstrates that the use of the First Aid Learning Administration Information System (SIAPP) is effective in improving community self-efficacy in Pontianak City in providing BLS. These findings highlight that structured, interactive, and accessible digital learning platforms can strengthen community members' psychological readiness, particularly their confidence in responding to emergencies such as out-of-hospital cardiac arrest (OHCA). Further research employing controlled study designs and long-term follow-up is warranted to evaluate the sustainability of self-efficacy improvements and their impact on actual first aid behavior in real-world settings.

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