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LUCEMUS: An Innovative Educational Ludo Game for Enhancing Self-Efficacy in Musculoskeletal Injury First Aid among Rural School-Settings

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ABSTRACT

Introduction:*Musculoskeletal injuries are common among school-age children, and rural student may have higher risk and limited access to first-aid education. Low self-efficacy in providing first aid may hinder appropriate initial injury management, highlighting the need for innovative educational approaches to improve students' confidence and preparedness*
Objectives: *To evaluate changes in students' self-efficacy before and after participating in LUCEMUS, a Ludo-Based educational game for musculoskeletal injury first aid*
Methods: *A one-group pretest-posttest study involving 32 seventh-grade students from a rural junior highn school. area. Partisipants' self-efficacy was measured using an adapted 10-item General Self-Efficacy Scale. Paired-sample t-test was used after checking assumptions.*
Results: *The mean self-efficacy score increased from 28.24 to 33.07, with a mean difference of 4.83. The difference was statistically, reported as $p < 0.001$ indicating that the LUCEMUS game demonstrated significant effect students' self-efficacy in providing first aid for musculoskeletal injuries.*
Conclusions: *LUCEMUS, an educational board game integrating Ludo with musculoskeletal injury first aid scenarios, effectively enhanced students' self-efficacy in rural student. LUCEMUS was associated with improved self-efficacy, but controlled studies are needed to confirm its effectiveness and impact on actual first-aid knowledge. This game-based learning approach has the potential to serve as an engaging and innovative health education strategy to strengthen students' confidence and preparedness in managing musculoskeletal injuries.*

Introduction

More than 4.7 million people worldwide experience injuries, and this condition is most commonly encountered among school-aged children. School-aged children constitute one of the groups most vulnerable to injuries (Nastiti et al., 2023). One of the most common injuries experienced by school-aged children is musculoskeletal injury, often triggered by unsafe environmental conditions during children's activities (Usman et al., 2021). Injuries can impair physical functioning and may lead to disability (Hendrawan et al., 2024). Furthermore, injuries contribute to school absenteeism and decreased concentration during learning activities (Nadira et al., 2025). Recent estimates from the World Health Organization (WHO), indicate that about 1.17 billion cases of musculoskeletal disorders occur worldwide. The 2018 RISKESDAS reported a musculoskeletal injury prevalence of 9.2%. In East Java, the prevalence of sprains reached 5.83%, with school environments being among the most common locations for such injuries (Kemenkes RI, 2018). Musculoskeletal injuries in adolescent have a hign prevalence and required preventive strategies from school-age (Martins et al., 2020). Rural areas are particularly vulnerable due to limited parental supervision and unsafe environmental conditions. Limited

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access to information and injury management education further increases the risk of injuries in rural communities (Puvanachandra et al., 2024).

An effective first-aid method for musculoskeletal injuries is the R.I.C.E. technique, consisting of Rest, Ice, Compression, and Elevation. This method aims to reduce pain and swelling (IFRC, 2016). The application of the R.I.C.E. principle during the acute phase is intended to minimize pain and edema, thereby reducing secondary tissue damage (Dubois & Esculier, 2020). Providing effective first aid requires confidence and self-efficacy. Self-efficacy refers to individual's perception of their capability to perform actions required to achieve desired outcomes (Bandura, 1977). Self-efficacy influences individual's willingness to take action and serves as an essential competency in providing first aid, including in school settings. Therefore, self-efficacy is crucial before schoolchildren perform first-aid procedures (Nastiti et al., 2023). Concerning first aid management, self-efficacy determines readiness and accuracy when managing musculoskeletal injuries. Although self-efficacy is crucial for first aid provision, school residents often demonstrate limited confidence in responding to emergencies and injuries (Avsar & Karakaya, 2025; Azizah et al., 2024)

Before schoolchildren can perform appropriate first-aid measures, they require health education to stimulate critical thinking and improve self-efficacy. Various educational media can be utilized, one of which is the Ludo board game. Board-game-based learning can enhance learners' attention and engagement by creating an active, interactive, and enjoyable learning environment (Ayu et al., 2026). Ludo is a strategy board game played by several individuals, requiring strategic thinking and decision-making. Consequently, Ludo can be adapted as an educational medium for solving everyday problems (Pawazah et al., 2023). Based on the above rationale, this study aimed to analyze the effect of LUCEMUS, a Ludo-based educational game containing musculoskeletal injury scenarios and R.I.C.E.-based management procedures, on improving self-efficacy among schoolchildren in providing first aid in rural areas.

Methods

Study Design

The present study applied a quasi-experimental design using a one-group pretest-posttest approach.

Setting

The study was conducted at junior high school in Jember Regency from April to May 2025.

Research Subject

The study consisted of 32 students. Respondents selected through proportionate stratified random sampling. The inclusion criteria were: (1) seven-grade students, (2) willingness to participate, and (3) completion of the study procedures. Respondents received a simulation-based intervention using a modified Ludo game containing R.I.C.E. procedures (Rest, Ice, Compression, and Elevation).

Instrument

Self-efficacy was measured using an adapted General Self-Efficacy Scale (GSE) consisting of 10 items rated on 4-point Likert scale. Total scores ranged from 10–40, with higher scores indicating better self-efficacy. All items were valid ($r > 0.288$), and reliability testing demonstrated a Cronbach's Alpha value of 0.847.

Intervention

Data collection began with a pretest questionnaire measuring self-efficacy in managing musculoskeletal injuries. Subsequently, respondents participated in LUCEMUS (Musculoskeletal Injury Ludo), modified with various musculoskeletal injury scenarios. The game was conducted

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in groups of four students. Players alternately rolled dice to determine their movement and the color of the square reached. The color determined the type of case card or challenge to be completed. These cards contained questions or demonstrations of first-aid procedures for musculoskeletal injuries. Participants were required to answer questions or demonstrate management procedures according to the provided scenario. Throughout the game, facilitators guided the activity and provided feedback regarding participants' responses and skills. Following the implementation of the game, respondents completed a posttest questionnaire to assess changes in self-efficacy.

Data analysis

The data were analyzed to determine changes in students' self-efficacy scores before and after the intervention was performed using a paired-samples t-test in SPSS version 25.0.

Etchical Consideration

Ethical approval for this study was obtained from Etchics Committee of Universitas dr. Soebandi, with etchical clearance number 858/KEPK/UDS/III/2025

Results

The demographic characteristics of the respondents are presented in Table 1.

Table 1 Respondent Characteristic (Cambria font 11pt, Center, space 1)

Characteristic	Category	Frequency	Percentage (%)
Gender	Male	16	50
	Female	16	50
	Total	**32**	**100%**
Age	12	6	18.8%
	13	25	78.1%
	14	1	3.1%
	Total	**32**	**100**

As presented in Table 1, the distribution of respondents by gender was equal, with males and females each comprising 50% of the study sample. In terms of age, most respondents were 13 years old (78.1%), followed by 12-year-olds (18.8%), whereas only a small proportion were 14 years old (3.1%).

Table 2 Paired-Samples t-Test Results for Self-Efficacy Scores Before and After the LUCEMUS Intervention (Cambria font 11pt, Center, space 1)

Variable	n	Mean	Mean Difference	SD	Range (Min-Max)	p-value
Pre-test	32	28.24	4.83	4.96	13-38	0.000
Post-test	32	33.07		3.87	23-40	

As shown in Table 2, the paired-samples t-test analysis yielded a p-value of less than 0.05, revealing a significant difference in students' self-efficacy in providing first aid management of musculoskeletal injuries before and after participation in the LUCEMUS intervention.

Discussion

The findings demonstrated that the LUCEMUS educational game, a Ludo-based learning medium incorporating first-aid scenarios for musculoskeletal injuries, had a significant effect on students' self-efficacy in rural areas. The difference observed pre-test and post-test indicates an improvement in students' confidence in performing first-aid procedures for musculoskeletal

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injuries. These findings are supported by a quasi-experimental study conducted in Taiwan, which reported that educational board games significantly enhance students' learning engagement and create more meaningful learning experiences (Zhang & Hsu, 2023). The results further strengthen the evidence that game-based learning is an effective educational strategy for optimizing self-efficacy in health-related contexts.

Previous research has suggested that game-based first-aid education can overcome several limitations associated with conventional first-aid training, particularly among non-professional populations and adolescents. This approach has been demonstrated significant potential to improve learners' motivation, reinforce knowledge retention, and strengthen confidence in applying first-aid techniques in real-life situations (Farooq et al., 2025). Similarly, other studies have demonstrated that game-based educational interventions in first-aid training produce greater improvements across multiple learning outcomes compared to traditional teaching methods (Vancini et al., 2023). In the present study, LUCEMUS functioned as an educational medium that integrated elements of competition, first-aid simulation, and collaboration, all of which contributed to strengthening students' self-efficacy.

The concept of LUCEMUS combines the traditional Ludo board game with musculoskeletal injury first-aid scenarios, thereby integrating gameplay with visual learning media. Educational games have been reported to increase participants' attention by up to 94% and improve long-term retention of learning materials by approximately 50%. An enjoyable learning environment encourages students to become more active and independent learners while enhancing analytical thinking through strategy-based gameplay (Putri & Nastiti, 2025). Furthermore, Ludo is a familiar game among Indonesian adolescents, which may reduce psychological barriers to learning. This positive affective condition can stimulate one of the primary sources of self-efficacy, namely physiological and affective states. According to Bandura, positive emotions and lower levels of anxiety contribute to stronger beliefs in one's own capabilities (Bandura, 1977). School-based first aid education programs can improve safety and optimize student preparedness in handling injuries (Hassan et al., 2024).

In rural settings, limited access to healthcare professionals and the availability of health-related facilities and infrastructure make first-aid competence particularly important among school-aged children. Therefore, these findings are highly relevant in the rural context. Children and adolescents living in rural communities frequently face restricted access to healthcare services, healthcare professionals, and first-aid training opportunities (Balakrishnan & Velusamy, 2025; Melo et al., 2024). Consequently, individuals in rural areas are often required to provide immediate assistance when injuries occur before professional healthcare services become available.

Self-efficacy reflects a person's belief in their capability to perform actions needed to accomplish desired goals. According to Bandura (2013), self-efficacy are devired from four primary sources: mastery experiences, vicarious experience, verbal persuasion, and emotional states. The modified Ludo game containing musculoskeletal injury scenarios provided students with opportunities to gain mastery experiences through solving various first-aid case scenarios. When students successfully answered questions or correctly demonstrated first-aid procedures, they experienced success that strengthened their confidence in their own abilities. In addition, students gained vicarious experiences by observing their peers successfully complete similar tasks. The discussions and feedback provided by facilitators throughout the game functioned as verbal persuasion, further enhancing participants' self-efficacy (Maadleh et al., 2025).

Overall, the findings demonstrate that LUCEMUS, a modified Ludo game incorporating musculoskeletal injury management scenarios, is an effective educational medium for improving self-efficacy in first-aid provision among students in rural school-settings. The utilization of this game provides an active, enjoyable, and contextual learning experience that supports and

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strengthens students' confidence in delivering first aid when faced with musculoskeletal injury cases within their communities, particularly in rural settings.

Conclusion

LUCEMUS, which integrates the traditional Ludo game with musculoskeletal injury first-aid scenarios, effectively improves students' self-efficacy in rural areas. The game-based learning approach provides an active, enjoyable, and contextual learning experience that strengthens students' confidence in delivering first aid. LUCEMUS has the potential to become an innovative health-education medium for improving first-aid preparedness and response among adolescents in rural communities.

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