Jurnal Kesehatan Kusuma Husada
Universitas Kusuma Husada Surakarta
Volume 17 No 2, Hal 86-95, Juli 2026
ISSN: 2087 – 5002 | E-ISSN: 2549 – 371X
https://doi.org/10.34035/jk.v17i2.2120

EFFECTIVENESS OF A SCHOOL-BASED EDUCATIONAL INTERVENTION IN IMPROVING FIRST AID COMPETENCY FOR INJURY MANAGEMENT AMONG SCHOOLCHILDREN

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ABSTRACT

Background: Childhood injuries remain a leading public health concern worldwide and frequently occur in school environments. The ability to provide appropriate first aid immediately after an injury is essential for reducing complications and improving recovery outcomes. This study investigated the effectiveness of a structured, school-based educational intervention in improving first-aid competency among elementary school students.
Methods: A quasi-experimental study employing a pretest-posttest nonequivalent control group design was conducted among 144 elementary school students selected through purposive sampling. Participants were allocated into an intervention group (n = 72) and a control group (n = 72). Students in the intervention group received a structured first aid education program delivered over three consecutive days using a validated learning module, while the control group continued routine school health activities. First aid competency was assessed before and after the intervention using a validated questionnaire. Data were analyzed using paired-samples and independent-samples t-tests, with statistical significance established at $p < 0.05$.
Results: The intervention and control groups demonstrated comparable baseline competency scores prior to the educational program. Following the intervention, the intervention group exhibited a marked improvement in first aid competency, whereas no meaningful change was observed among students in the control group. Comparative analysis confirmed that post-intervention competency scores were significantly higher in the intervention group than in the control group ($p < 0.001$).
Conclusion: Educational programs in schools effectively enhance children's skills in providing first aid for injuries.
Keywords: first aid, first aid competency, injury management, school-based education, school children, school health

INTRODUCTION

Unintentional injuries continue to represent one of the most important causes of morbidity and mortality among school-age children worldwide. According to the World Health Organization (WHO), unintentional injuries, including falls, burns, cuts, fractures, choking, and road traffic incidents, account for a substantial proportion of deaths and long-term disabilities among children aged 5–14 years (World Health Organization,

Volume 17 No 2, Hal 86-95, Juli 2026
ISSN: 2087 – 5002 | E-ISSN: 2549 – 371X
https://doi.org/10.34035/jk.v17i2.2120

2021). In addition to their physical consequences, injuries may adversely affect children's psychological well-being, school attendance, academic performance, and quality of life (Peden & Oyegbite, 2021). Most childhood injuries occur in environments where children spend the majority of their time, particularly at home and at school (Alkhamis & Abdulkader, 2020). Consequently, schools play a strategic role not only in preventing injuries but also in promoting appropriate responses when injuries occur.

The first few minutes following an injury are critical in determining clinical outcomes. Appropriate first aid can reduce injury severity, prevent complications, minimize permanent disability, and improve recovery. Conversely, delayed or inappropriate first aid may increase morbidity and mortality, healthcare costs, and the burden on healthcare services (World Health Organization, 2021). Because children frequently witness or sustain minor injuries during school activities, equipping them with basic first-aid knowledge and practical skills is an important component of school health promotion (Tse et al., 2023).

Although the significance of first aid training is acknowledged, research across nations consistently indicates that students have minimal understanding and insufficient practical skills in first aid (García-Blaya et al., 2025; Syabariyah & Jehsoh, 2025). Many children are unable to recognize emergency situations, assess injuries appropriately, or provide immediate assistance before professional medical care becomes available (Soni & Agrawal, 2025). These deficiencies may be attributable to the absence of structured first-aid education in school curricula, limited opportunities for practical training, and insufficient reinforcement of emergency preparedness in elementary education (García-Blaya et al., 2025).

Educational interventions in schools have been increasingly recommended as an effective approach to enhance children's health literacy and emergency preparedness (World Health Organization, 2021). Schools provide a structured learning environment where health education can be delivered systematically through age-appropriate teaching methods, interactive learning activities, demonstrations, simulations, and repeated practice (Alaçam & Olgan, 2021; Roland et al., 2026; Smith et al., 2021). Earlier research has demonstrated that educational programs in school settings can enhance students' understanding, attitudes, confidence, and practical first-aid skills (Abdelmalik et al., 2022; Rekleiti et al., 2013). Nevertheless, the effectiveness of such interventions may vary depending on the educational approach, intervention content, duration, and sociocultural context. Evidence regarding school-based first aid education among elementary school children in Indonesia remains limited, particularly studies employing quasi-experimental designs to evaluate changes in first aid competency.

Indonesia continues to experience a considerable burden of childhood injuries. Elementary school children are frequently exposed to injury risks during sports, playground activities, commuting to and from school, and daily interactions with their environment (Ministry of Health, Republic of Indonesia,2021). Although the School Health Program (Usaha Kesehatan Sekolah/UKS) aims to promote healthy behaviors and improve students' health status, first aid education has not yet been systematically implemented or rigorously evaluated as part of routine school health activities (Ministry of Health, Republic of Indonesia, 2021). Generating empirical evidence on the effectiveness of school-based first aid education is therefore essential to support evidence-based school health policies and strengthen injury prevention programs.

Accordingly, this study aimed to evaluate the effectiveness of a school-based educational intervention in enhancing first aid competency among elementary school children using a quasi-experimental pretest-posttest nonequivalent control group design. The findings are expected to contribute to the growing body of evidence supporting the

Volume 17 No 2, Hal 86-95, Juli 2026
ISSN: 2087 – 5002 | E-ISSN: 2549 – 371X
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integration of structured first aid education into school health programs and to inform policymakers, educators, and healthcare professionals seeking sustainable strategies to improve children's preparedness for injury-related emergencies.

RESEARCH METHOD

This study adopted a quasi-experimental approach using a pretest-posttest nonequivalent control group design to assess the effectiveness of a school-based first-aid education program in improving injury management competency among elementary school children. The research was conducted in two public elementary schools located in Banjarsari District, Surakarta, Indonesia. The study involved 144 students, comprising 72 participants in the intervention group and 72 participants in the control group. Participants were selected using purposive sampling according to predetermined eligibility criteria established before data collection. Students in the intervention group received a school-based first-aid educational program delivered through a structured learning module. The research team developed the module in accordance with existing first-aid guidelines and principles of school health education, and it was evaluated and approved by experts prior to implementation.

The intervention was delivered in three sessions over three consecutive days, with each session covering essential first aid topics, including injury recognition, appropriate first aid procedures, demonstrations, and supervised practical exercises. The educational sessions utilized engaging teaching techniques, including lectures, group discussions, demonstrations, and simulation-based practice, to improve students' understanding and practical skills in delivering first aid for typical injuries. In contrast, students in the control group continued to receive the routine school health education and activities regularly provided by the school, without additional first-aid education during the study period.

First aid competency was measured using a structured questionnaire that was validated by experts and demonstrated good reliability (Cronbach's alpha > 0.70). Data were collected before (pretest) and after (posttest) the intervention using standardized procedures. Data analysis was performed using IBM SPSS Statistics. Descriptive statistics were calculated to summarize participant characteristics and first aid competency scores. Baseline homogeneity between the intervention and control groups was assessed prior to hypothesis testing. Changes in competency within each group were analyzed using the paired-samples t-test, whereas differences between groups after the intervention were assessed using the independent-samples t-test. Statistical significance was determined at a two-tailed p-value < 0.05.

Ethical approval for this study was obtained from the Health Research Ethics Committee of Universitas Kusuma Husada Surakarta (Approval Number: 008/UKH.L.02/EC/IX/2022). Permission to conduct the research was granted by the participating schools. Written informed consent was obtained from parents or legal guardians before students were enrolled in the study. Throughout the research process, participant confidentiality, anonymity, and voluntary participation were maintained in accordance with established ethical principles.

RESULTS

Table 1. Baseline First Aid Competency Scores among Schoolchildren Before the Intervention

Group	n	Mean	Median	SD	Min–Max	95% CI
Intervention	72	21.24	21.00	3.608	12–27	20.11–22.36
Control	72	21.17	21.00	3.414	14–28	20.10–22.23

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Table 1. summarizes participants' first-aid competency before the implementation of the educational intervention. Baseline scores were comparable between groups. The intervention group achieved a mean score of 21.24 ± 3.61, whereas the control group had a mean score of 21.17 ± 3.41. Median values were identical (21.00), and the confidence intervals overlapped substantially, indicating similar initial competency levels before the intervention.

Following completion of the educational program, first aid competency improved noticeably among students in the intervention group. The mean posttest score increased to 24.74 ± 3.25, compared with 21.02 ± 2.98 in the control group. The intervention group also demonstrated a higher median score and a greater upper score limit, suggesting better overall competency after participating in the structured educational program (Table 2.). Descriptively, schoolchildren who received the school-based educational intervention demonstrated substantially higher post-intervention first aid competency scores than those in the control group. In the intervention group, the mean score exceeded that of the control group by 3.72 points, indicating a meaningful improvement in first aid competency following the educational intervention. The non-overlapping confidence intervals further suggest a higher level of competency among students who participated in the intervention, although statistical significance should be confirmed through inferential analysis.

Table 2. Post-Intervention First Aid Competency Scores among Schoolchildren

Group	n	Mean	Median	SD	Min–Max	95% CI
Intervention	72	24.74	25.00	3.246	16–30	23.73–25.75
Control	72	21.02	22.00	2.975	16–27	20.10–21.95

Table 3. Baseline Homogeneity Test of First Aid Competency Scores Between the Intervention and Control Groups

Group	n	Mean	SD	*p*-value
Intervention	72	21.24	3.608	0.097
Control	72	21.17	3.414	

Baseline equivalence between groups was examined before evaluating intervention effectiveness. The homogeneity analysis demonstrated no statistically significant difference between the intervention and control groups (p = 0.097), confirming that both groups were comparable before the educational program was implemented (Table 3). These findings demonstrate that both groups were comparable before the school-based educational intervention was implemented.

Table 4. Effect of the School-Based Educational Intervention on First Aid Competency among Schoolchildren in the Intervention Group

Assessment	n	Mean	SD	SE	*t*	*p*-value
Pretest	72	21.24	3.608	0.557	5.712	<0.001
Posttest	72	24.74	3.246	0.501		

Table 4. presents the within-group comparison of first aid competency scores before and after the school-based educational intervention in the intervention group. The mean first aid competency score increased from 21.24 (SD = 3.608; SE = 0.557) at baseline to

Volume 17 No 2, Hal 86-95, Juli 2026
ISSN: 2087 – 5002 | E-ISSN: 2549 – 371X
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24.74 (SD = 3.246; SE = 0.501) following the intervention, representing an average improvement of 3.50 points. The reduction in standard deviation and standard error after the intervention indicates not only an increase in overall competency but also slightly more consistent performance among participants in the posttest. The paired-samples t-test demonstrated a statistically significant increase in first aid competency after the intervention ($t = 5.712$, $p < 0.001$). These findings indicate that the school-based educational intervention was effective in significantly improving schoolchildren's competency in providing first aid for injuries.

Results for the control group are presented in Table 5. Mean competency scores changed only slightly, from 21.17 ± 3.41 before the study period to 21.02 ± 2.98 after routine school activities. Statistical testing showed that this difference was not significant ($t = 0.316$, $p = 0.753$), indicating that routine school health activities alone did not yield measurable improvements in first-aid competency.

Table 5. Effect of the School-Based Educational Intervention on First Aid Competency among Schoolchildren in the Control Group

Assessment	n	Mean	SD	SE	*t*	*p*-value
Pretest	72	21.17	3.414	0.527	0.316	0.753
Posttest	72	21.02	2.975	0.459		

Table 6. Comparison of Post-Intervention First Aid Competency Scores Between the Intervention and Control Groups

Group	n	Mean	SD	*t*	*p*-value
Intervention	72	24.74	3.246	4.906	<0.001
Control	72	21.02	2.975		

A comparison of post-intervention outcomes is shown in Table 6. Students who participated in the structured educational program achieved significantly higher first aid competency scores than those in the control group (24.74 ± 3.25 versus 21.02 ± 2.98). Independent-samples t-test analysis confirmed a statistically significant difference between groups ($t = 4.906$, $p < 0.001$), supporting the effectiveness of the school-based educational intervention in enhancing first aid competency among elementary school children.

DISCUSSION

The present study demonstrated that a structured, school-based educational intervention significantly improved first-aid competency among elementary school children. Before the intervention, no statistically significant difference was identified between the intervention and control groups, indicating comparable baseline characteristics. This similarity strengthens the study's internal validity because improvements observed after the intervention are more likely to reflect the educational program rather than preexisting differences among participants. Establishing baseline equivalence is particularly important in quasi-experimental research, where random allocation is not feasible, as it enhances confidence in the interpretation of intervention outcomes. Therefore, the intervention carried out in this study is considered essential to achieving the expected results (León-Guereño et al., 2023; Timmins, 2013; Yadav et al., 2026).

Students who participated in the educational program achieved substantially higher post-intervention competency scores than those who continued with routine school health

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activities. These findings indicate that structured first aid education can effectively improve children's ability to recognize injury situations, determine appropriate responses, and perform essential first aid procedures. The absence of meaningful improvement in the control group further suggests that routine school health activities alone may be insufficient to develop practical emergency response competencies among elementary school students.

The intervention's effectiveness may be explained by the characteristics of school-based learning. Schools provide an organized environment in which health education can be delivered systematically using age-appropriate instructional strategies. The educational program in this study combined lectures, demonstrations, simulations, discussions, and practical exercises, enabling students not only to acquire knowledge but also to develop procedural skills and confidence in responding to injury situations. Active learning approaches have consistently been shown to produce greater improvements in learning outcomes than passive information delivery because they encourage students to apply newly acquired knowledge in realistic situations (World Health Organization, 2021).

The findings of this study are consistent with previous research demonstrating that first aid education significantly improves children's knowledge and practical competency (Tse et al., 2023). This research indicated that organized first-aid training significantly improved understanding and practical first-aid skills among primary school students aged 7–14 years. In a similar manner, a systematic review conducted by Tse et al. determined that first aid education in schools significantly enhances students' knowledge, confidence, and emergency response abilities in different educational environments (García-Blaya et al., 2025; Yadav et al., 2026).

The absence of significant improvement in the control group further emphasizes the importance of structured educational interventions. Students who participated only in routine school health activities did not demonstrate measurable gains in first aid competency during the study period. This finding suggests that first aid competency is unlikely to improve without targeted educational programs specifically designed to develop emergency response knowledge and practical skills. Similar observations have been reported in previous studies, indicating that children generally possess limited first aid knowledge unless they receive formal training (Li et al., 2026).

From a theoretical perspective, the findings can be explained through principles of experiential learning and social cognitive theory. Demonstrations, simulations, and repeated practice provide opportunities for observational learning, behavioral rehearsal, and self-efficacy development, all of which contribute to improved competency. Children learn more effectively when they actively participate in problem-solving activities and practice psychomotor skills rather than relying solely on didactic instruction. Increased confidence gained through repeated practice may also facilitate the retention of first aid knowledge and improve the likelihood of appropriate responses during real-life emergencies (Mukhalalati et al., 2022; Nabavi & Bijandi, 2024).

The findings also have important implications for school health practice. Integrating structured first aid education into the School Health Program (Usaha Kesehatan Sekolah/UKS) could strengthen children's emergency preparedness and contribute to injury prevention efforts. Community health nurses, school nurses, and teachers may collaborate to deliver standardized first aid education using evidence-based materials and practical simulations. Regular refresher training should also be considered to maintain competency over time, as previous studies have demonstrated that first aid knowledge and skills may decline without reinforcement (Anggraini et al., 2024; Markenson et al., 2016; Safwa Salsabila & Apriliani, 2025).

Volume 17 No 2, Hal 86-95, Juli 2026
ISSN: 2087 – 5002 | E-ISSN: 2549 – 371X
https://doi.org/10.34035/jk.v17i2.2120

Several limitations should be considered when interpreting these findings. First, the quasi-experimental design without random allocation may introduce selection bias despite the comparable baseline characteristics observed between groups. Second, participants were recruited from only two elementary schools in a single district, potentially limiting the generalizability of the findings to other geographic settings. Third, the study evaluated short-term changes in first aid competency immediately following the intervention; therefore, the long-term retention of knowledge and skills remains unknown. Future studies should employ randomized controlled designs involving larger and more diverse populations to strengthen causal inference and improve external validity. Longitudinal follow-up is also recommended to examine knowledge retention and skill maintenance over time. In addition, future research should incorporate objective performance assessments, such as simulation scenarios or standardized practical examinations, to evaluate whether improvements in competency translate into effective first-aid behaviors in real-world emergency situations. Investigating implementation strategies across different school environments would further support the development of sustainable school-based first aid education programs. To improve and maintain students' first aid skills, future interventions should incorporate regular refresher training, simulation-based practice, and periodic competency assessments. Schools also play a crucial role by integrating first aid education into the school health curriculum, supporting routine emergency drills, and fostering collaboration with community health nurses and local healthcare providers to ensure the sustainability and effectiveness of these programs. The study was conducted in only two elementary schools within a single subdistrict, which may not be representative of schoolchildren from different geographical or socioeconomic backgrounds. Third, first-aid competency was assessed immediately after the intervention; therefore, long-term retention of knowledge and skills could not be determined. Finally, competency was measured using a structured questionnaire rather than direct observation of students' performance in simulated or real-world emergency situations, which may not fully reflect their practical first-aid abilities.

Overall, the present study provides evidence that school-based educational interventions are effective in improving first aid competency among elementary school children. Integrating structured first aid education into routine school health programs may represent an effective strategy to enhance children's preparedness for injury-related emergencies and ultimately reduce preventable injury-related morbidity.

CONCLUSION

This study demonstrated that a structured school-based first aid education program significantly enhanced first aid competency among elementary school children. Students who participated in the intervention showed a substantial improvement in their post-intervention competency scores, whereas no significant improvement was observed among students who received routine school health activities. These findings indicate that structured educational interventions implemented in school settings can effectively strengthen children's ability to recognize injuries, make appropriate decisions, and perform essential first-aid procedures. Integrating first aid education into routine school health programs has considerable potential to improve children's preparedness for injury-related emergencies and to support broader injury prevention initiatives. Incorporating practical, age-appropriate first aid training into elementary school curricula may contribute to developing a generation of students who are better equipped to respond safely and effectively during emergency situations.

Volume 17 No 2, Hal 86-95, Juli 2026
ISSN: 2087 – 5002 | E-ISSN: 2549 – 371X
https://doi.org/10.34035/jk.v17i2.2120

RECOMMENDATIONS

Based on this study's findings, it is recommended that structured first-aid education be integrated into routine school health programs to improve schoolchildren's preparedness and competence in managing common injuries. Schools should collaborate with community health nurses, teachers, and local health authorities to implement standardized, evidence-based first-aid training, supported by interactive learning methods, including demonstrations, simulations, and hands-on practice. In addition, policymakers should consider incorporating first aid education into the elementary school curriculum as part of comprehensive health promotion and injury prevention initiatives. Future research should evaluate the long-term retention of first aid knowledge and skills through longitudinal follow-up, include participants from more diverse educational and geographical settings, and employ randomized controlled designs where feasible. In addition, future studies should incorporate objective, performance-based assessments, such as simulation scenarios or observed structured practical examinations, to determine whether improvements in competency translate into effective first-aid behaviors in real emergency situations.

ACKNOWLEDGMENTS

The authors wish to express their heartfelt thanks to Universitas Kusuma Husada Surakarta for its financial and institutional support throughout this research. The authors express their gratitude to the elementary schools involved, as well as the students, teachers, and school administrators, for their essential collaboration and enthusiastic engagement throughout the conduct of this study. Their commitment and support were essential to the successful implementation of this research.

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Volume 17 No 2, Hal 86-95, Juli 2026
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Volume 17 No 2, Hal 86-95, Juli 2026
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