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The effect of flash card games on knowledge and attitudes toward diarrhea prevention among elementary school students

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Abstract

Background: Diarrhea remains one of the environment-related diseases that poses a public health problem, particularly among elementary school-aged children. A lack of knowledge and awareness regarding diarrhea prevention can increase the risk of diarrhea in children. One preventive measure that can be taken is providing health education using innovative media such as flashcard games.

Purpose: to determine the effect of flashcard games on elementary school students' knowledge and attitudes toward diarrhea prevention.

Method: This study employed a quantitative approach with a quasi-experimental design using a non-equivalent control group. The sample consisted of 102 respondents, comprising an experimental group and a control group, selected through purposive sampling. Data were collected using pre-test and post-test questionnaires and analyzed using the Paired T-test, Wilcoxon test, and Mann-Whitney U test.

Result: The results of the study indicate that there was a significant difference in knowledge levels between before and after the intervention in the experimental group ($p < 0.001$). There was also a significant difference in attitudes between before and after the intervention ($p < 0.001$). Additionally, there was a significant difference in the change in knowledge between the experimental and control groups ($p < 0.001$) and a significant difference in the change in attitudes between the experimental and control groups ($p < 0.001$).

Conclusion: Flashcard games have an impact on improving elementary school students' knowledge and attitudes toward diarrhea prevention.

Suggestion: Schools are encouraged to utilize innovative educational tools, such as flashcard games, in their health education programs. Health workers are encouraged to collaborate with schools in implementing health promotion initiatives focused on preventing diarrhea.

Keywords: Attitudes; Diarrhea Prevention; Elementary School Students; Flashcard Games; Knowledge.

INTRODUCTION

Diarrhea remains a major public health problem, particularly among children in developing countries. According to the World Health Organization (WHO), diarrhea is one of the leading causes of morbidity and mortality among children worldwide, with approximately 1.7 billion cases occurring each year (World Health Organization, 2024). In Indonesia, diarrhea continues to be a significant public health concern, with a prevalence of 4.1% (Ministry of Health of the Republic of Indonesia, 2018).

School-aged children are considered a vulnerable group to diarrheal diseases (Yohana, Nurdin, Fitria, & Dinen, 2024). The occurrence of diarrhea is influenced by various factors, including environmental sanitation, personal hygiene practices, access to clean water, food safety, knowledge, and attitudes (Aolina, Sriagustini, & Supriyani, 2020; Tuang, 2021). According to Blum's theory, environmental and behavioral factors play important roles in determining an individual's health status (Wijayanti & Widyastari,

2018). Furthermore, Lawrence Green's theory explains that knowledge is a predisposing factor influencing the formation of health-related behaviors (Rianti, Apriliawati, & Sulaiman, 2020).

Knowledge is an important component in the development of healthy behaviors (Ciptaningrum & Sudaryanto, 2024). Children who possess adequate knowledge regarding the causes, transmission, and prevention of diarrhea are more likely to adopt appropriate preventive behaviors. Therefore, health education is needed to improve knowledge and foster positive attitudes toward diarrhea prevention (Azizah & Prakoso, 2024). Elementary school children are an appropriate target for health education because, at this age, they are more receptive to information and more capable of developing positive habits that may continue into adulthood (Ichwan, Yuniar, & Erawan, 2016; Nuka, Andini, & Mahmudiono, 2024).

One educational medium that can be utilized is the flash card. A flash card is a visual learning medium consisting of illustrated cards that can help improve students' attention, comprehension, and memory retention (Kustanti & Widyarani, 2022). The use of attractive and age-appropriate educational media is expected to enhance the effectiveness of health message delivery among children.

Several previous studies have demonstrated that flash card-based education is effective in improving health knowledge and attitudes among school-aged children. A study conducted by Sidabukke et al. reported improvements in students' knowledge and skills following education using flash cards (Azzahra, Palin, & Chifdillah, 2025). Similarly, Masrizal et al. found significant improvements in knowledge and

attitudes after the implementation of health education interventions (Masrizal, Perwati, Pradipta, & Fauzi, 2024). Comparable findings were also reported by Kustantu and Widyarani, who observed increased knowledge levels following the use of flash card media (Kustanti & Widyarani, 2022).

RESEARCH METHOD

This study employed a quantitative approach using a quasi-experimental design with a non-equivalent control group design. The study was conducted in the working area of the Talang Bakung Community Health Center, Jambi City. The study population consisted of 137 fifth-grade students from SDN 40 and SDN 109 Kota Jambi. A total of 102 respondents were selected using purposive sampling and divided into an experimental group ($n = 51$) and a control group ($n = 51$).

Data were collected using knowledge and attitude questionnaires administered before (pre-test) and after (post-test) the intervention. The experimental group received health education using flash card games, while the control group did not receive any intervention. Data were analyzed using univariate and bivariate analyses. Univariate analysis was used to describe respondent characteristics and study variables. The Wilcoxon Signed-Rank Test was used to analyze changes in knowledge scores, the Paired T-Test was used to analyze changes in attitude scores, and the Mann-Whitney U Test was used to determine differences between the experimental and control groups. Statistical significance was set at $p < 0.05$.

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RESEARCH RESULTS**Table 1. Characteristics of Respondent (N=51)**

Variable	Exsperiment	Control
Gender (n/%)		
Male	20/39.0	28/55.0
Female	31/61.0	23/45.0

The table above shows that the majority of respondents in the experimental group were female 31 (61.0%), while the majority in the control group were male 28 (55.0%).

Table 2. Distribution of Knowledge and Attitude Scores Before and After the Intervention in the Experimental Group

Variable	Mean	SD	Min	Max
Knowledge				
Pre Test	83.2680	11.57565	53.33	100.00
Post Test	91.3725	9.45578	60.00	100.00
Attitude				
Pre Test	87.5882	8.00294	66.00	100.00
Post Test	90.8039	7.73827	66.00	100.00

According to the table, the respondents' average knowledge score before the intervention was 83.27 ± 11.58 , with a range of 53.33–100.00. After the intervention, the mean knowledge score increased to 91.37 ± 9.46 , with a range of 60.00–100.00. This indicates an increase in respondents' knowledge scores following the intervention. the mean attitude score of respondents in the experimental group before the pre-test was 87.59 ± 8.00 , with a minimum score of 66.00 and a maximum score of 100.00. After the post-test, the average attitude score increased to 90.80 ± 7.74 , with a minimum score of 66.00 and a maximum of 100.00. These results indicate an increase in the average attitude score of 3.22 points in the experimental group.

Table 3. Differences in Knowledge Before and After the Intervention

Variable	Positive Ranks	Negative Ranks	Ties	Z-score	P- Value
Knowledge	35	1	15	-5.191	<0.001

The results of the Wilcoxon Signed-Rank Test indicate that most respondents showed an increase in knowledge scores after the intervention—specifically, 35 respondents—while 1 respondent showed a decrease and 15 respondents showed no change. A p-value of < 0.001 indicates that there is a significant difference between knowledge scores before and after the intervention.

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Table 4. Differences in Attitude Before and After Intervention

Variable	Mean Pre	Mean Post	P- Value
Attitude	87.58	90.80	<0.001

According to the table, the respondents' average attitude score before the intervention (mean pre) was 87.58, while after the intervention (mean post) it increased to 90.80. Statistical test results showed a p-value < 0.001 ($p < 0.05$), indicating a significant difference between attitude scores before and after the intervention. This suggests that the intervention had a positive effect on improving respondents' attitudes toward diarrhea prevention.

Table 5. The Effect of Flash Card Games on Knowledge and Attitude of Diarrhea Prevention

Variable	Group	N	Mean Rank	Z	P- Value
Knowledge	Experiment	51	66.71	-5.281	< 0.001
	Control	51	36.29		
Attitude	Experiment	51	62.26	-3.681	<0.001
	Control	51	40.74		

Based on the results of the Mann-Whitney U test, the p-value for knowledge was < 0.001 ($p < 0.05$), indicating a significant difference in post-test knowledge scores between the experimental group and the control group. Based on the mean rank, the experimental group had a higher score (66.71) compared to the control group (36.29), indicating that the flashcard game intervention was effective in improving knowledge of diarrhea prevention in children. For the attitude variable, the results of the Mann-Whitney U test showed a p-value of <0.001 ($p < 0.05$), indicating a significant difference in post-test attitude scores between the experimental group and the control group. Based on the mean rank, the experimental group had a higher score (62.26) compared to the control group (40.74), indicating that the flashcard game intervention influenced children's attitudes toward diarrhea prevention.

DISCUSSION

The results of this study showed a significant change in students' knowledge before and after the implementation of flash card games ($p < 0.001$). The Wilcoxon test indicated that 35 respondents experienced an increase in their knowledge scores, 1 respondent experienced a decrease, and 15 respondents showed no change. These findings

suggest that the majority of respondents demonstrated improved knowledge after receiving the flash card games intervention.

The improvement in knowledge may be attributed to the use of flash card games as a health education medium that combines visual elements and game-based learning. Information presented through pictures and simple messages helps students understand diarrhea prevention more easily. In addition, the learning-through-play approach encourages active participation, allowing students to better absorb and retain the information provided.

According to Notoatmodjo, knowledge is the result of an individual's sensory perception of an object through the human senses. Knowledge is one of the important factors influencing health behavior. Individuals with better knowledge tend to have a greater ability to understand and apply healthy behaviors appropriately (Notoatmodjo, 2007).

The findings of this study are consistent with those of Nuka et al., who reported that the use of flash card media significantly improved students' knowledge. Similarly, other research found that education using flash card games effectively increased elementary school students' knowledge regarding communicable disease prevention. Comparable results were also reported who concluded that flash card media are

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effective in improving health knowledge among school-aged children (Nuka et al., 2024; Masrizal, Perwati, Pradipta, & Fauzi, 2024; Kustanti & Widyarani, 2022; Azzahra et al., 2024).

The results of this study showed a significant change in students' attitudes before and after the implementation of flash card games ($p < 0.001$). These findings indicate that the intervention was effective in improving positive attitudes toward diarrhea prevention among elementary school students.

According to Notoatmodjo, attitude is an individual's response or reaction toward an object, which is formed through learning processes, experiences, and information received. Adequate knowledge can encourage individuals to develop more positive attitudes toward health-related behaviors (Notoatmodjo, 2007).

The improvement in attitudes observed in this study may be attributed to the fact that students not only received information about diarrhea but also gained a better understanding of the importance of personal hygiene, safe food selection, proper sanitation practices, and environmental cleanliness. The delivery of information through flash card games in an attractive and easy-to-understand format helped students receive health messages more effectively, thereby fostering more positive attitudes toward diarrhea prevention.

During the intervention, students actively participated and showed great enthusiasm throughout the learning activities. Their active involvement facilitated the effective delivery of health messages and contributed to positive changes in attitude. These findings are in line with other studies conducted which reported that educational game-based media can improve positive attitudes toward clean and healthy living behaviors among school-aged children (Ichwan et al., 2016; Harismanto, Oktavidiati, & Astuti, 2019; Masrizal et al., 2024).

The Mann-Whitney test showed a significant difference in knowledge change between the experimental and control groups ($p < 0.001$). This finding indicates that the improvement in knowledge observed in the experimental group was greater than that in the control group, demonstrating that flash card games had a significant effect on students' knowledge of diarrhea prevention.

Flash card media provide a more engaging learning experience compared to conventional educational methods. The use of pictures, colors, and game-based activities helps students focus their attention and better understand the educational content. As a result, health information is more easily received and retained, leading to improved knowledge regarding diarrhea prevention. These findings are supported by previous studies demonstrating that flash card media are effective in improving health knowledge among school-aged children by creating an active, enjoyable, and easily understandable learning environment (Nuka et al., 2024; Masrizal et al., 2024; Kustanti & Widyarani, 2022; Azzahra et al., 2024).

The Mann-Whitney test revealed a significant difference in attitude change between the experimental and control groups ($p < 0.001$). This result indicates that flash card games had a significant effect on the development of positive attitudes toward diarrhea prevention among elementary school students.

This effect may be explained by the active learning process promoted through flash card games. By participating in educational games, students become more engaged in learning activities and are more likely to understand the benefits of diarrhea prevention behaviors. Such experiences help foster positive attitudes toward maintaining personal hygiene, environmental cleanliness, and healthy lifestyle practices.

In addition to enhancing understanding, flash card games help students remember health messages through visual aids and interactive activities. This process facilitates more positive attitude changes compared to students who did not receive the intervention. These findings are consistent with previous studies showing that educational game-based media are effective in improving positive attitudes and health awareness among school-aged children (Ichwan et al., 2016; Harismanto et al., 2019; Masrizal et al., 2024).

CONCLUSION

The findings of this study indicate that flash card games significantly improved knowledge and attitudes toward diarrhea prevention among elementary school students. Significant changes were observed in knowledge and attitude scores before and after the

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intervention in the experimental group ($p < 0.001$). Furthermore, significant differences in changes in knowledge and attitudes were found between the experimental and control groups ($p < 0.001$). These results suggest that flash card games can be used as an effective health education medium to enhance students' knowledge and foster positive attitudes toward diarrhea prevention. Therefore, the implementation of flash card games is recommended as an innovative educational strategy in school-based health promotion programs.

SUGGESTION

Schools are encouraged to incorporate flash card games into health education activities to improve students understanding and attitudes regarding diarrhea prevention. Health workers and educators may also collaborate in developing interactive and engaging educational media to support health promotion programs among school-aged children.

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