International Journal of Dental Sciences
www.dentaljournal.in
E-ISSN: 2663-4708
Received: 28-02-2026; Accepted: 31-03-2026; Published: 15-04-2026
Volume 8, Issue 2, 2026, Page No. 20-23

Improving Fourth-Grade students' knowledge through a snakes and ladders game conducted after PowerPoint-based health education

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Abstract
Dental health education is intended to improve both knowledge and behavioral practices. Educational media used in health promotion include PowerPoint presentations and the snakes and ladders game. School-based oral health programs that apply various instructional approaches have been shown to effectively improve students' oral health, as well as their related attitudes and behaviors. This study aimed to examine the effect of implementing the snakes and ladders game following PowerPoint-based health education on the knowledge of fourth-grade students.
This study utilizes a Quasi-experimental design featuring a Pretest and Post-Test control group. The study included 100 students who were divided into two groups. The intervention group consisted of 50 fourth-grade students from MIN 3 Bireuen who received dental health education through PowerPoint presentations accompanied by a snakes and ladders game, while The control group comprised 50 fourth-grade students—26 from MIN 9 and 24 from MIN 19—who received only PowerPoint-based health education. All groups participated in four sessions of dental health education and were assessed using knowledge questionnaires at pretest, post-test I (one month after the intervention), and post-test II (three months after the intervention).
There was a difference in knowledge between the intervention and control groups from post-test I to post-test II, as well as from pretest to post-test II, with statistically significant results ($p = 0.008$ and $p = 0.002$). The knowledge scores in the intervention group increased significantly compared to those in the control group.
The snakes and ladders game, following health education delivered through PowerPoint media, enhances the knowledge of fourth-grade student.

Keywords: Snake ladder game, knowledge, and oral health education

Introduction

Basic Health Research data shows that the prevalence of dental caries in Indonesia is high at 88.8% compared to periodontal disease 74.1%, or other oral diseases 5.3% [1]. Given the high rate of dental caries, it is important to strive for sufficient knowledge and information to maintain oral health and behaviour change [2].
Health education serves as a significant primary prevention strategy. Health education seeks to enhance understanding of oral health and promote positive behavioural changes when established from a young age [3]. Dental health education through counseling aims to change behaviour from the aspects of knowledge, attitudes and also actions towards healthy behaviour [4].
Grade IV students are students with an age range of 9-10 years, when students' interest in learning is quite high, memory and ability to understand the material is strong. Health behaviour at this age is more cooperative than students of younger age groups [5]. Certain studies indicate that oral health education programs in schools utilizing diverse approaches effectively enhance oral health, as well as attitudes and behaviours associated with it [3].
Various types of methods used in oral health education include lectures, flipcharts, brochures, videos, and presentations [6]. Power point is a presentation tool that has several advantages, including being able to produce better visual effects and interesting presentations because there are games of letters, colours, text / image animations, photos, and diagrams that can stimulate children to better understand the information provided [7].
Improving children's knowledge and attitudes in addressing the games to convey health and hygiene messages can serve as an alternative method for educating on fundamental health concepts [8].
Snakes and ladders media is considered very effective in repeating material in learning that is difficult to understand and less effective if conveyed verbally [9].
Based on the background description, the authors are interested in examining the impact of Snakes and ladders game conducted after PowerPoint-based health Education on improving fourth-grade students' knowledge

Research Method

This research is a quasi-experimental research with pretest and post-test control group design. This research was conducted on students of Min 3, 9 and 19 Bireuen during September - December 2022. The research subjects were all fourth grade students of Min 3, 9, and 19 Bireuen who were selected based on the inclusion and exclusion criteria of 100 students.
This study was approved by the Ethics Committee of the Faculty of Dentistry, Gadjah Mada University (Ref. No: 159/KE/FKG-UGM/EC/2022). Researchers distributed informed consent to all subjects to obtain approval then conducted a Pretest. Researchers provided oral health education to the intervention and control groups. The intervention group was given Snakes and ladder game conducted after PowerPoint-Based health education while the control group was only given education using power point media. Health education in this study was conducted 4 times with an interval of 1 day which was then evaluated after 1 and 3 months.
Knowledge in this study were measured using a questionnaire. The knowledge questionnaire consists of 15

questions adopted from a previous study [10, 11], the correct answer is worth 1 and wrong 0. The knowledge score is converted into a value range of 0-100 which is divided into 3 categories: good (76-100), fair (56-75), poor (<55).

Results

The characteristics of respondents in this study can be seen in Tabel 1.

Tabel 1: Distribution of Student Characteristics in Madrasah Ibtidaiyah Negeri 3, 9 and 19 Bireuen, Aceh (n=100)

No	Student Characteristics	Explanation	Fourth grade students						Total	
			MIN 3		MIN 9		MIN 19			
			n	%	n	%	n	%	n	%
1	Gender	Male	22	44	13	50	13	54	48	48
		Female	28	56	13	50	11	46	52	52
2	Age	9	25	50	15	58	9	37	49	49
		10	25	50	11	42	15	63	51	51

Note: n=Number of subjects; %=percentage.

Tabel 1 shows that majority of fourth grade students in MIN 3, 9 and 19 Bireuen are female as much as 52% and aged 10 years as much as 51%.

Effect of Intervention on Knowledge and Behaviour of Dental and Oral Health Maintenance

Table 2: Comparison of Knowledge at Pretest, Post-Test I, and Post-Test II between Intervention and Control Groups

Variable	Intervention Groups	Control Groups	*p**
	Median (25% - 75%)		
Knowledge			
Pretest	40(33-53)	40(33-47)	0,168
Post-test I	67(53-73)	63,5(40-73)	0,156
Post-test II	67(53-80)	53(40-67)	**0,001**

Notes: * Mann Whitney test

The statistical analysis presented in Table 2 shows a significant difference in the mean knowledge scores at post-test II between the two groups after receiving dental health education, with a p-value of 0.001.

Table 3: Changes in Knowledge in Pretest, Post-Test I, and Post-Test II of Intervention and Control Groups

Variable	Intervention Groups Median (25% - 75%)			*p**	Control Groups Median (25% - 75%)			*P*
	Pretest	Post-Test I	Post-Test II		Pretest	Post-Test I	Post-Test II	
Knowledge	40 (33-53)	67 (53-73)	67 (53-80)	<0,001	40 (33-47)	63,5 (40-73)	53 (40-67)	**<0,001**

Note: * Kruskal Wallis test

Table 3 indicates that there was a statistically significant difference between the two groups before and after receiving dental health education, with a p-value of less than 0.05.

Table 4: Differences in Knowledge from Pretest to Post-Test I and Post-Test II in the Intervention Groups

Data	Intervention Groups			
	Min	Max	Mean Difference	*p**
Knowledge				
Pretest to Post-test I	13-33	73-100	20,8	<0,001
Post-test I to Post-test II	33-100	100-100	3,18	0,074
Pretest to Post-test II	13-100	73-100	23,98	<0,001

Notes: *Wilcoxon test

The statistical analysis presented in Table 4 indicates that there were significant differences in students' knowledge within the intervention group from pretest to post-test I and from pretest to post-test II, with p-values of less than 0.05.

Table 5: Differences in Knowledge from Pretest to Post-Test I and Post-Test II in the Control Groups

Data	Control Groups			
	Min	Max	Mean Difference	*p**
Knowledge				
Pretest to Post-test I	13-20	67-80	18,14	<0,001
Post-test I to Post-test II	20-7	80-93	-4,12	0,074
Pretest to Post-test II	13-100	67-93	14,02	<0,001

Notes: *Wilcoxon test

The statistical analysis presented in Table 5 indicates that there were significant differences in students' knowledge within the control group from pretest to post-test I and from pretest to post-test II, with p-values of less than 0.05.

Comparison of Data Difference of Knowledge and Oral Health Maintenance Behavior

Table 6: Difference in Knowledge at Pretest, Post-Test I, and Post-Test II between Intervention and Control Groups

Variable	Median (25%-75%)		*p**
	Intervention Groups	Control Groups	
Pengetahuan			
Difference A^{o}	14(7-33)	20(7-27)	0,427
Difference B$^{\approx}$	0(0-13)	-6(-14-6)	**0,008**
Difference C§	26(13-34)	13(7-20)	**0,002**

Notes:* Mann Whitney test; ^{o} difference A (difference of post-test I to Pretest); ≈ difference B (difference of post-test II to post-test I); § difference C (difference of post-test II to Pretest).

Table 6 shows that there is a significant difference between the mean difference in knowledge scores of the intervention and control groups in post-test II to post-test I and post-test II to pretest with a significance value of p=0.008 and p=0.002, respectively.

Discussion

The results of statistical analysis in Table 3 show a change in knowledge in the intervention and control groups from Pretest, post-test I, and post-test II with a significant value ($p<0.001$). This states that there are differences in knowledge in the two groups after being given dental health education. This indicates that the two groups have varying levels of knowledge following dental health education. The intervention group received dental health education through PowerPoint media and had reinforcement via a snakes and ladders game, while the control group was provided with dental health education using PowerPoint and participated in a question-and-answer session at end of the meeting.

Based on table 3, we can see that in the evaluation of knowledge after 1 month, both groups experienced an increase in score while in the second evaluation after 3 months the intervention group had a fixed knowledge score and the control group experienced a decrease in score compared to the evaluation after 1 month. The findings of this study align with the work of GheethaPriya 12, indicating that educational approaches utilizing game media enhance children's knowledge scores more effectively. Fitriana [13] also stated that providing education using power point media will make learning more interesting, deliver the content of the material more effectively and efficiently, and the selection of the right power point slides can help create a strong understanding and memory of the content of the material.

The knowledge of students from Pretest to post-test I and from Pretest to post-test II (tables 4 and 5) in both the intervention and control groups revealed a considerable difference in knowledge levels in both groups before and after receiving dental health education at 1 and 3 months, with a value of ($p <0.001$). This is in line with Saidah's research [14] which states that there is an effect of providing oral health education on the level of children's knowledge.

The difference in knowledge from post-test I to post-test II in both groups did not show a significant value ($p>0.05$). Based on the mean difference in the intervention and control groups (3.18 and -4.12), it was found that the difference in knowledge from evaluation after 1 month (post-test I) to evaluation 2 (post-test II) in the control group experienced a large decrease in value. This happened because dental health education in the intervention group was given reinforcement through snakes and ladders games and the control group did not. These findings are backed by the theory of Suhermin sit. Wulanyani 15 asserts that the snakes and ladders game offers multiple benefits, including the ability to foster an enjoyable educational environment, enhance student engagement in learning activities, ensure that students' cognitive outcomes from learning are stable and organized appropriately for retention, and allow for the knowledge stored in memory to be accessible at any time

The analysis results (table 2) indicate that the significant comparison of knowledge between the intervention and control groups was observed in post-test II ($p = 0.001$). The intervention group's knowledge scores surpassed those of the control group. This aligns with the theory that the snakes and ladders game approach can transform a passive learning environment into an active one, enabling children to absorb more messages or information shared through the game (16).

The analysis outcomes regarding the difference in knowledge scores between the intervention and control groups (table 6) indicated a significant difference in the rise of student knowledge scores between the groups, with a significance value of $p <0.05$. This aligns with Hamdalah's17 findings, which indicate that health education delivered through snakes and ladders game media leads to improvements in knowledge, attitudes, and oral health practices

Conclusion

Snakes and Ladders Game Conducted After PowerPoint-Based Health Education further increases the knowledge of grade IV students

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