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Snakes and Ladders Game-Based Education to Improve Oral and Dental Health Knowledge Among Elementary School Students

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ABSTRACT

Background: Dental and oral health problems can have a negative impact on daily life, including decreasing general health, reducing levels of self-confidence, and interfering with performance and attendance at school or work. Dental and oral health in Indonesia among residents aged ≥ 3 years is 56.9% and the prevalence of dental and oral health problems in Aceh Province is 57%. Snakes and ladders is a game that can be used as a learning medium. Objective: This research is to determine the effect of snakes and ladders game education on increasing knowledge of dental and oral health among students at SDN 54 Banda Aceh City. Research method: used is quantitative research with a quasi-experimental method, with a pretest-posttest nonequivalent control group design. The sampling technique was purposive sampling of students at SDN 54 Banda Aceh City, consisting of 62 students. The test used is the Independent T-Test. Results: students' knowledge before being given education on the snakes and ladders game had an average value of 63.23. Meanwhile, based on students' knowledge after being given education on snake games, the average value was 80.85 with p 0.001 (< 0.005).

INTRODUCTION

Health serves as a foundational pillar for guaranteeing human quality of life, encompassing physical, mental, social, and economic stability. In particular, early childhood health is critical to ensuring optimal growth and development. Health maintenance must be prioritized by every individual, both in terms of general healthcare and specialized oral healthcare (Riolina & Karyadi, 2022).

According to the Draft Global Oral Health Action Plan (2023–2030), the target for 2030 includes a 10% relative reduction in the global burden of oral diseases, alongside achieving an 80% coverage rate for primary oral health coverage(Global Oral Health Action, 2023). Conversely, in Indonesia, despite the high burden of oral health conditions, only 11.2% of affected individuals seek professional medical treatment (Global Oral Health Action, 2023).

Data from the 2023 Indonesian Health Survey (SKI) indicates that the prevalence of dental and oral health problems among individuals aged ≥ 3 years is 56.9%. While the Decay-Missing-Filled Teeth (DMF-T) index across all age groups demonstrated a decline compared to the 2018 Basic Health Research (Riskesdas) findings, oral health in Indonesia still warrants rigorous attention. Specifically, 5-year-old children remain in a high DMF-T index category, averaging 6.7%. In Aceh Province, the prevalence of oral health problems reaches 57% (Kemenkes, 2023).

If left unaddressed, oral disease leads to functional limitations in daily activities and a reduced quality of life, accompanied by diminished self-esteem (Nova Ghea, 2019). Impaired masticatory function can prevent complete digestion of food, ultimately hindering optimal child growth(Wijayanti, 2023).

Oral Health Education (OHE) represents a strategic effort toward behavior modification, encouraging individuals to actively maintain their oral hygiene while providing procedural understanding of proper oral care (Boy, 2024). Education itself is defined as a structured framework oriented toward facilitating individuals to actualize and optimize their internal potential (Purnama, 2023). During the primary school years (ages 6–11), children undergo a significant cognitive transition toward more logical

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and rational thought processes. This cognitive maturity enables them to sequence, classify, and systematically organize facts as problem-solving strategies (Wulandari, 2024).

The integration of educational media functions as an effective tool to support learning processes, serving as a primary strategy to enhance students' comprehension regarding the importance of oral health care (Hasan, 2021). For children, learning through play is an effective methodology for cognitive reinforcement. Play is inherently engaging, which helps counteract the natural tendency of children to lose focus quickly; thus, educators use instructional aids or games to stimulate interest (Panjaitan & Suriadi, 2023). Conversely, traditional educational strategies such as social media campaigns or passive videos present notable limitations—primarily their unidirectional communication flow and lack of interactivity—which may reduce memory retention (Gumilar et al., 2025).

An innovative educational medium capable of addressing these limitations is the board game Snakes and Ladders. This medium is developed by adapting the traditional game to align with learner characteristics, serving as an effective tool to deliver educational messages (Wati, 2021). Through this interactive approach, passive, one-way instruction is transformed into an engaging, enjoyable, and contextual learning process. Consequently, student enthusiasm and active participation increase, leading to deeper knowledge retention (Nurlisa et al., 2022).

Based on this background, this study was conducted to evaluate the effect of Snakes and Ladders game-based education on oral health knowledge among elementary school students. The findings are expected to serve as an empirical foundation for schools and healthcare practitioners in designing effective oral health interventions.

METHOD

This study employed a quasi-experimental design featuring a pretest-posttest non-equivalent control group design. The study evaluated two distinct cohorts: an intervention group and a control group. The intervention group received oral health education delivered via the Snakes and Ladders board game, whereas the control group received standard oral health education via lecture-based instruction.

The population comprised all 595 students at SDN 54 Banda Aceh. A sample of 62 students was selected using non-probability purposive sampling based on specific inclusion criteria: cooperative behavior, ability to read and communicate effectively, capacity for peer collaboration, and age between 9 and 10 years. Data were collected via pretest and posttest questionnaires and underwent editing, coding, entry, and cleaning prior to statistical analysis.

Univariate analysis was conducted to examine the demographic profile and variable characteristics, including the independent variable (Snakes and Ladders media) and dependent variable (oral health knowledge). Bivariate analysis was performed using the Independent T-Test to evaluate the educational effect on oral health knowledge at a significance threshold of $p < 0.05$.

RESULT

Univariate Analysis

A sample of 62 students from SDN 54 Banda Aceh was categorized into an intervention group ($n = 31$) and a control group ($n = 31$).

Table 1. Demographic Characteristics of Students at SDN 54 Banda Aceh in 2026 ($n = 62$)

No.	Demographic Variable	n	%
Gender			
1	Male	35	56,5%
2	Female	27	43,5%
	Total	62	100%
Age			
1	9 years	56	90,7%
2	10 years	6	9,3%
	Total	62	100%

Table 1 indicates that the majority of respondents were 9 years old ($n = 56$, 90.7%) and male ($n = 35$, 56.5%).

Table 2. Oral Health Knowledge Distribution in the Intervention Group Pre- and Post-Intervention ($n = 31$)

No.	Knowledge Level	Pre		Post	
		n	%	n	%
1	Good	7	22.6%	27	**77.42%**
2	Moderate	16	51.6%	7	**51.6%**
3	Poor	8	25.8%	0	**0%**
	Total	31	100%	31	**100%**

Table 2 demonstrates that prior to the Snakes and Ladders educational intervention, only 7 students (22.6%) exhibited a "Good" level of knowledge. Following the intervention, the majority shifted to the "Good" category n = 24, (77.4%).

Table 3. Oral Health Knowledge Distribution in the Control Group Pre- and Post-Intervention (n = 31)

No.	Knowledge Level	Pre		Post	
		n	%	n	%
1	Good	3	9.7%	13	**41.9%**
2	Moderate	17	54.8%	15	**48.4%**
3	Poor	11	35.5%	3	**9.7%**
	Total	31	100%	31	**100%**

Table 3 illustrates that in the control group (lecture method), only 3 students (9.7%) demonstrated "Good" knowledge at baseline, which increased to 13 students (41.9%) post-intervention.

Table 4. *Shapiro-Wilk* Normality Test for Oral Health Knowledge Scores (n = 62)

Variable	Statistics (t)	Significance (p)
Pretest	0.949	0.151
Posttest	0.967	0.447

As shown in Table 4, the Shapiro-Wilk test yielded p-values > 0.05 for both pretest and posttest scores, confirming that the data were normally distributed.

Bivariate Analysis

Table 5. Pretest and Posttest Knowledge Analysis in the Intervention Group (Snakes and Ladders Game)

Measurement	Mean	N
Pretest	63.23	31
Posttest	80.85	31

Statistical testing presented in Table 5 shows a baseline mean score of 63.23 and a post-intervention mean score of 80.85 (a mean increase of 17.62) with p = 0.001 (p < 0.05). This indicates a statistically significant improvement in oral health knowledge following the Snakes and Ladders game intervention.

Table 6. Pretest and Posttest Knowledge Analysis in the Control Group (Lecture Method)

Measurement	Mean	N
Pretest	60.65	31
Posttest	70.97	31

As shown in Table 4.6, the lecture method produced a baseline mean of 60.65 and a post-intervention mean of 70.97 (a mean increase of 10.32) with $p = 0.002$ ($p < 0.05$). Although both interventions yielded statistically significant gains, the intervention group exhibited a larger mean improvement (17.62 vs. 10.32), indicating that the game-based approach was more effective than traditional lectures.

DISCUSSION

The evaluation conducted at SDN 54 Banda Aceh revealed that the proportion of students achieving a "Good" knowledge score in the intervention group rose from 22.6% ($n = 7$) at pretest to 77.4% ($n = 24$) at posttest. Statistical analyses confirmed significant gains in both the intervention group ($p = 0.001$) and the control group ($p = 0.002$). However, the intervention group achieved a larger mean improvement ($\Delta = 17.62$) compared to the control group ($\Delta = 10.32$). These results indicate that Snakes and Ladders game-based education exerts a stronger positive effect on oral health knowledge than standard lecture methods.

These findings align with research at SDN Candi 01 Semarang, which evaluated dental health knowledge intervention media. Setiadi reported a mean knowledge gain of 6.35 in the Snakes and Ladders group compared to 2.14 in the video group ($p < 0.001$), demonstrating that interactive board games are more effective than video-based instruction for knowledge acquisition in elementary students (Setiadi, 2020).

Child educational development is governed by both internal and external factors. External factors include environmental and cultural determinants, whereas internal factors encompass physiological and psychological attributes. Subject interest represents a vital internal factor that directly influences learning engagement and academic outcomes (Ramli, 2025).

To establish an active learning environment for primary school students, educators frequently adopt a game-integrated approach (Harsiw, 2020). By integrating educational content with play, this strategy sustains attention, mitigates boredom, and stimulates cooperative behaviors and sportsmanship through group interaction (Sutami, 2025).

Instructional media facilitates the effective transmission of concepts from educators to learners (Karomah, 2024). The Snakes and Ladders game enhances focus, fosters dynamic peer engagement, and builds confidence among elementary students while delivering health concepts (Darmawan, 2025). Designed to stimulate cognitive processing and concentration, the game enables children to read prompts, observe visual aids, and respond to health-related questions within a structured rule framework (Suzana et al., 2024).

Consequently, empirical data and supporting literature confirm that the Snakes and Ladders game serves as an effective educational intervention for improving oral health literacy among elementary school students.

CONCLUSION

Educational intervention using the Snakes and Ladders board game significantly improves dental and oral health knowledge among students at SDN 54 Banda Aceh ($p = 0.001, p < 0.05$).

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