

## Modified Snakes and Ladders Game as an Alternative Educational Media for Dental Caries Prevention among Elementary School Children

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### ABSTRACT

Dental caries is one of the most common oral health problems experienced by school-age children, particularly those aged 6–14 years, who are considered a vulnerable and critical age group for the development of dental caries. This study aimed to determine the difference in knowledge about dental caries before and after counseling using a modified snakes and ladders game as an educational media among students of class 3A and 3B at Wachid Hasyim 2 Elementary School, Surabaya. This study employed a quasi-experimental design with a one group pretest–posttest approach. The population consisted of all students in class 3A and 3B at Wachid Hasyim 2 Elementary School, Surabaya. A total of 44 students were selected using simple random sampling. Data were collected using a questionnaire and analyzed using the Wilcoxon test. The analysis showed a  $p$ -value  $< 0.05$ , indicating a significant difference in knowledge about dental caries before and after counseling using the modified snakes and ladders game as educational media. In conclusion, counseling using a modified snakes and ladders game is effective in improving knowledge about dental caries among elementary school students.

**Keywords:** dental caries knowledge; snakes and ladders game media; elementary school students

### INTRODUCTION

According to data from the World Health Organization (WHO) in 2018, approximately 68–72% of children worldwide experience dental caries. Data from the Basic Health Research (*Riskesdas*) 2018 reported that the prevalence of dental caries in the Indonesian population reached 45.3%. Among children aged 5–9 years, the proportion experiencing dental damage was 54.0%, while the average caries index among children aged 10–12 years was 1.89% [1]. Dental caries indicators are used to determine the condition of damaged primary and permanent teeth. One of the indicators used is the def-t index, which is a method to measure caries in primary teeth [2].

A preliminary observation conducted on 10 third-grade students at Wachid Hasyim 2 Elementary School, Surabaya, showed an average def-t value of 7.5, which falls into the very high category (def-t index  $> 6.6$ ). Dental caries is one of the most common oral health problems experienced by school-age children. Children aged 6–14 years are particularly vulnerable and represent a critical age group for dental caries because this period marks the transition from primary teeth to permanent teeth [3]. The high prevalence of dental caries among children is often associated with the frequent consumption of sweet and sticky foods, improper or infrequent tooth brushing, limited knowledge about oral health, and the absence of regular dental check-ups [4].

Dental caries in school-age children may result in reduced chewing ability, which can decrease appetite and lead to digestive problems. This condition can negatively affect children's growth and hinder their optimal development [5]. Food debris that remains attached to teeth and is not properly cleaned can cause tooth decay, leading to porous teeth, cavities, and other oral problems. Dental caries in children may also interfere with their development, including a potential decline in cognitive performance. If it persists over a long period, it may adversely affect the child's quality of life [3]. In addition, children with dental caries may experience difficulty pronouncing words correctly, which can make their speech less clear and harder to understand [6].

One of the ways to maintain oral hygiene and prevent dental caries is through regular tooth brushing [7]. Maintaining oral health is essential for overall body health, particularly for children, because the condition of primary teeth greatly influences the development of their permanent successors. Periodic dental care is therefore necessary to maintain optimal oral health [8]. One method to stop the progression of dental caries is restorative treatment such as dental fillings, especially when caries has affected the dentin and enamel layers [9]. In addition, children should pay attention to their dietary patterns and avoid sticky foods that contain high amounts of sugar. Preventing dental cavities also requires maintaining a healthy diet and undergoing regular dental examinations [10]. Dental caries can also be prevented by consuming fibrous and watery foods such as fruits and vegetables. Fruits with high fiber and water content have a natural self-cleansing effect that helps support oral health [11].

Promotive activities represent one approach to improving oral health and aim to change behavior through the enhancement of knowledge [12]. Health promotion not only teaches children proper tooth brushing techniques or healthy food choices but can also attract their attention and encourage the development of good oral health habits. Health education delivered solely through lectures or demonstrations tends to have only short-term effects. Engaging and enjoyable media can increase children's interest in learning. One educational medium that can be utilized is the snakes and ladders game [13]. The effectiveness and efficiency of oral health education are influenced by the appropriateness and suitability of the learning methods and media used. Educational media should not merely deliver information but also provide meaningful learning experiences [14]. A modified snakes and ladders game designed to improve oral health awareness represents a commonly played children's game that is cooperative, engaging, simple, educational, entertaining, and highly interactive when played together [15].

Based on the description above, the problem identified in this study is the high prevalence of dental caries among students of class 3A and 3B at Wachid Hasyim 2 Elementary School, Surabaya, in 2024. Therefore, this study aims to determine the difference in knowledge about dental caries before and after counseling using a modified snakes and ladders game as an educational medium among students of class 3A and 3B at Wachid Hasyim 2 Elementary School, Surabaya.

### METHODS

This study was conducted from August 2023 to March 2024 at Wachid Hasyim 2 Elementary School, Surabaya. This research used a quasi-experimental design with a one-group pretest–posttest approach. The design involved measuring the dependent variable before and after the intervention to determine the effect of the treatment. The research subjects were students of class 3A and 3B at Wachid Hasyim 2 Elementary School, Surabaya, consisting of 24 students in class 3A and 25 students in class 3B. The sample size was determined using the Slovin formula, resulting in 44 respondents. The sampling technique used was simple random sampling. During the implementation, the students were divided into 10 groups, each consisting of five students. The counseling activities were conducted gradually over a period of two weeks.

The independent variable in this study was health education using a modified snakes and ladders game as an educational medium. The intervention was delivered to the student groups through interactive gameplay designed to convey information related to dental caries and oral health. The dependent

variable was students' knowledge about dental caries. It was measured using a questionnaire administered before the intervention (pretest) and after the intervention (posttest) to assess changes in knowledge following the educational activity. Data analysis was performed after the data were collected and processed to test the research hypothesis. A paired t-test was used when the data were normally distributed, whereas the Wilcoxon test was applied when the data were not normally distributed.

## RESULTS

Table 1 shows that the mean score of knowledge before counseling about dental caries using the modified snakes and ladders game among third-grade students at Wachid Hasyim 2 Elementary School was categorized as poor. After counseling using the modified snakes and ladders game media, the knowledge level was categorized as good. This indicates that the modified snakes and ladders game media can improve students' knowledge. The statistical test results using the Wilcoxon test showed a p-value of 0.000 (<0.05). Therefore, there was a significant difference between knowledge before and after counseling using the modified snakes and ladders game media regarding dental caries among third-grade students at Wachid Hasyim 2 Elementary School, Surabaya.

Table 1. Level of knowledge about dental caries before and after counseling using the modified snakes and ladders game media

Phase	Knowledge		Hypothesis test result	
	Mean	Category	z	p-value
Before education	49.66	Poor	-5.819	0.000
After education	82.27	Good		

## DISCUSSION

Based on the analysis, the findings indicated a significant difference in students' knowledge before and after counseling using the modified snakes and ladders game media. Prior to the educational intervention, the average level of students' knowledge regarding dental caries was categorized as low. After the counseling activity was conducted, however, the average level of knowledge increased and was categorized as good. This improvement demonstrates that the educational intervention delivered through the modified snakes and ladders game was effective in enhancing students' understanding of dental caries. The media used in this activity contained educational material related to dental caries, including its causes, prevention, and the importance of maintaining oral hygiene. The material was presented in an attractive and interactive format so that students became more enthusiastic and actively involved during the learning process. Consequently, the students were able to receive and comprehend the information more effectively, which contributed to the observed improvement in their level of knowledge.

The findings of this study are consistent with previous research conducted among third-grade students at SDI Al-Azhar 33 Tasikmalaya, which reported that dental health education using the snakes and ladders game had a positive effect on improving students' knowledge of oral and dental health. The study showed a clear difference in respondents' knowledge levels before and after counseling about oral health. The use of the snakes and ladders game as an educational medium allowed the learning process to become more interactive and enjoyable. Students became more active in participating in the educational activities and demonstrated higher levels of enthusiasm during the counseling sessions. In addition, the presence of game elements encouraged students to pay closer attention to the educational material being delivered. This evidence suggests that the integration of game-based learning methods into health education can effectively increase students' knowledge of oral and dental health, particularly among elementary school children who tend to learn more effectively through engaging and participatory activities [16].

The relatively low level of knowledge regarding dental caries observed among respondents prior to the intervention may be influenced by several factors. One possible explanation is that previous health promotion or counseling activities were conducted without the use of engaging learning media. Without supportive educational tools, students may have difficulty maintaining their attention and interest during the learning process. As a result, the information delivered may not be fully understood or retained by the students. This lack of understanding can increase the risk of dental caries because children may not have adequate knowledge about proper oral hygiene practices and preventive behaviors. These findings are in line with previous research suggesting that the absence of attractive educational media in health promotion activities can reduce students' learning motivation and limit the effectiveness of knowledge transfer [17].

Games represent one form of stimulus that can be effectively utilized in teaching children about dental health education. School-age children generally possess the intellectual capacity and motor coordination necessary to participate in structured play activities with their peers. Through play, children can learn various concepts in an enjoyable and engaging manner. Playing games also introduces children to rules and structured activities, which can help develop discipline, cooperation, and problem-solving skills. For children, play is not merely a recreational activity but also an important medium for learning and development. According to several psychologists, play serves as an essential tool that supports children's physical, social, emotional, and cognitive development. Through games, children can develop physical coordination while simultaneously enhancing their social interaction skills and cognitive abilities, including memory, attention, and reasoning [18].

These findings are also consistent with the understanding that behavior is essentially a response or reaction of an individual to a stimulus [19]. In the context of this study, the stimulus refers to the modified snakes and ladders game media used during the educational intervention. The presence of this stimulus can generate responses among respondents in the form of increased knowledge or understanding, which is categorized as a covert response because it occurs internally within the individual. By presenting health education material through an engaging and stimulating medium such as a game, the learning process becomes more effective in eliciting cognitive responses from participants. Therefore, counseling activities that utilize the modified snakes and ladders game media containing information related to dental caries can successfully stimulate students' learning processes and ultimately increase their knowledge. This mechanism explains why the intervention implemented in this study was able to improve the level of knowledge among students at SD Wachid Hasyim 2 Surabaya.

The snakes and ladders game used in this research was intentionally modified to include attractive images, bright colors, and educational messages related to dental health. These modifications were designed to capture children's attention and encourage their active participation in the educational activity. During the counseling sessions, students appeared enthusiastic and engaged while participating in the game-based learning process. The enjoyable learning environment created through this approach can positively influence students' ability to receive and process information. When individuals receive information in a pleasant and stimulating context, they are less likely to feel bored or fatigued during the learning process. As a result, the information provided can be better understood, stored in memory, and eventually applied in daily life practices. Educational media therefore plays an important role in facilitating the learning process by helping students understand the material more easily. Messages delivered through visual and interactive media also have greater potential to attract attention and improve comprehension compared with conventional lecture-based methods [20,21].

The application of the modified snakes and ladders game media among students in classes 3A and 3B at SD Wachid Hasyim 2 Surabaya demonstrated a significant increase in knowledge levels between the pretest and posttest assessments. This improvement may be attributed to the fact that the educational media used in this study represents an interactive and enjoyable learning approach. Such an approach is particularly

suitable for elementary school students, who tend to learn more effectively through play-based and participatory activities. By integrating educational content into a game format, students are able to learn while playing, which enhances their interest and motivation in the learning process. In addition, the educational information related to dental caries becomes easier to understand because students encounter it repeatedly during the gameplay. The knowledge gained by respondents through this intervention can contribute to improved awareness and preventive behaviors related to oral health. Ultimately, increased knowledge about dental caries prevention may help reduce the risk of dental caries among students and contribute to improvements in their oral health status.

Despite these positive findings, this study also has several limitations that should be considered when interpreting the results. One notable limitation is related to the data collection instrument used in the study. The questionnaire instrument employed to measure students' knowledge had not undergone formal validity and reliability testing prior to its use. As a result, the accuracy and consistency of the measurement tool may not have been fully established. Future research is therefore recommended to conduct validity and reliability testing on data collection instruments before implementing them in research activities. By ensuring that research instruments meet appropriate methodological standards, future studies can produce more accurate and reliable findings regarding the effectiveness of educational interventions in improving students' knowledge of dental health.

## CONCLUSION

Based on the results of the study and the discussion, it can be concluded that the use of the modified snakes and ladders game media in counseling was effective in improving students' knowledge. After the educational intervention, the average knowledge score of students increased and was categorized as good, indicating that the modified snakes and ladders game media was effective in delivering information and enhancing students' understanding.

## Ethical consideration, competing interest and source of funding

-This study was conducted after obtaining informed consent from all prospective respondents. Ethical approval for this research was granted by the Health Research Ethics Committee of Poltekkes Kemenkes Surabaya with approval number EA/2456/KEPK-Poltekkes\_Sby/V/2024.

-There is no conflict of interest related to this publication.

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