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Effect of Interactive Education Using Puzzle Media on Oral Health Maintenance Knowledge among elementary school children

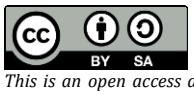
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ABSTRACT

Background: Oral and dental health is an important component of schoolchildren's overall health and can affect their quality of life and learning process. Preliminary data collected from 10 third-grade students at MIN 27 Lambaro, Aceh Besar, showed that most students had dental caries, with a mean deft index of 5.6, categorized as high, and an OHI-S score of 3.2, categorized as poor. This condition indicates that students' oral health maintenance remains inadequate, highlighting the need for engaging and interactive educational approaches, one of which is puzzle-based education. Objective: This study aimed to determine the effect of interactive education using puzzle media on oral and dental health maintenance knowledge among third-grade students at MIN 27 Lambaro, Aceh Besar. Methods: This study employed a quasi-experimental design with a pre-test and post-test control group. The sample consisted of 74 students divided equally into an intervention group and a control group, with 37 students in each group, selected using total sampling. Data were collected using a questionnaire and analyzed using paired-samples and independent-samples t-tests. Results: Knowledge increased in the intervention group, with a mean difference of 5.02 points and a p-value of 0.001 ($p < 0.05$). In the control group, the increase was not statistically significant, with a mean difference of 0.21 points and a p-value of 0.052 ($p > 0.05$).Conclusion: Interactive education using puzzle media was effective and significantly improved oral and dental health maintenance knowledge among third-grade students at MIN 27 Lambaro, Aceh Besar

INTRODUCTION

Oral and dental health is an important component of overall health that affects quality of life and therefore represents an essential aspect of health development, particularly in developing countries such as Indonesia. Successful health development, including dental health, is supported by improvements in health knowledge, awareness, and behavior (Purnama et al., 2024). Oral health efforts encompass environmental factors, knowledge, education, awareness, and dental health management, including prevention and treatment. Insufficient awareness of the importance of maintaining oral and dental health can reduce productivity because of the consequences experienced by individuals (Pay, Wali, Pinat, et al., 2023).

Oral health maintenance should be initiated from an early age, even during pregnancy. The government has identified three groups as being particularly vulnerable to oral and dental diseases: pregnant women, preschool children, and schoolchildren (Pay, Wali, Fankari, et al., 2023). Elementary school age is an appropriate period for establishing a strong foundation for a healthy and productive population because health is an important determinant of human resource quality (Octavianita et al., 2024). Schoolchildren are vulnerable to oral and dental health problems, particularly because this is the period when primary teeth begin to be replaced by permanent teeth (Tsakila & Purnama, 2025).

According to the 2018 Basic Health Research, 54% of children aged 5–9 years experienced dental caries, compared with 41.4% of children aged 10–14 years. In Aceh, the 2018 Riskesdas reported dental caries prevalence of 53% among children aged 5–9 years and 44.23% among those aged 10–14 years. Although 97.34% of children in Aceh reported brushing their teeth every day, only 2.81% brushed at the

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recommended times (Kementerian Kesehatan RI, 2018). These findings indicate inadequate knowledge and practice related to oral health maintenance among elementary schoolchildren in Aceh.

Based on data from the Indonesian Health Survey (SKI), the prevalence of oral and dental health problems in Indonesia remains high, at 56.9% among the population aged ≥3 years. The prevalence was 67.3% among children aged 5–9 years and 55.6% among those aged 10–14 years. However, only 10.2% received dental health services, and only 2.8% brushed their teeth correctly twice a day (Kemenkes, 2023). These findings indicate that oral and dental health maintenance among schoolchildren needs to be improved through health education.

Oral health maintenance behaviors should be established from an early age. The school-age period is considered an appropriate time to instill values and develop positive health behaviors (Kasihani et al., 2021). At this age, children also demonstrate a strong willingness to learn and curiosity. One strategy for improving oral health behaviors among elementary schoolchildren is oral health education (Nasita & Purnama, 2025). Promotive and preventive programs are important approaches to reducing oral and dental diseases. Among elementary schoolchildren, game-based methods, including educational puzzles, have been considered effective as health education media.

Puzzle media can be used in oral health education because it is interactive and encourages children's active participation through learning while playing. This approach may increase children's interest in and understanding of oral health materials (Lisna & Riyaningrum, 2024). According (Ulliana et al., 2025) reported that puzzle media was effective in improving children's knowledge of oral hygiene and dental care. Nevertheless, puzzle-based education also has limitations because its effectiveness may depend on educator supervision and may emphasize knowledge acquisition more than long-term changes in oral health behavior.

Research from (Hutami et al., 2019) found that the use of dental health puzzle games as an educational medium was effective in facilitating the delivery of oral health information to elementary schoolchildren. Similarly, (Kartini, 2023) reported that puzzle-based learning improved students' learning outcomes. Compared with lectures, elementary school students demonstrated better understanding when materials were delivered through puzzle media because the approach was more engaging and illustrated ways to maintain oral and dental health

METHOD

This study used a quasi-experimental design with a pre-test and post-test control group. The study population comprised all third-grade students at MIN 27 Lambaro, Aceh Besar. Total sampling was used, meaning that the entire population was included as study participants. A total of 74 students participated and were divided into two groups: Class A (intervention group), consisting of 37 students, and Class B (control group), consisting of 37 students.

The research instrument was a questionnaire containing questions relevant to the study topic, accompanied by puzzle media (jigsaw puzzle) as an educational aid for the third-grade students at MIN 27 Lambaro, Aceh Besar.

Data collection began with a pre-test administered through interviews with participants in Class A (intervention group). Participants then received learning activities using the puzzle method. Class B (control group) received the same learning sequence but with a lecture-based method. In the second week after the intervention, a post-test was administered to both classes through interviews. Data were analyzed using paired-samples t-tests and independent-samples t-tests. Data processing was performed using SPSS

RESULT

Table 1. Paired-samples t-test results in the intervention and control groups

Group	Mean	Mean Difference	p-value
Intervention – Pre-test	6.30	5.02	0.001
Intervention – Post-test	11.32		
Control – Pre-test	6.41	0.21	0.052
Control – Post-test	6.62		

Table 1 shows differences in the mean knowledge scores between the pre-test and post-test in both groups. In the intervention group, the mean score increased from 6.30 before the intervention to 11.32 after the intervention, resulting in a mean difference of 5.02 points. The paired-samples t-test showed a statistically significant difference ($p = 0.001$, $p < 0.05$), indicating that puzzle-based learning significantly improved students' oral and dental health knowledge. In the control group, the mean score increased from

6.41 to 6.62, with a mean difference of 0.21 points. The paired-samples t-test showed no statistically significant difference ($p = 0.052$, $p > 0.05$), indicating that the lecture method did not produce a statistically significant improvement in students' oral and dental health knowledge

Table 2. Frequency distribution of oral and dental health maintenance knowledge before and after the intervention

Group/Time	Knowledge Category	f	%
Intervention – Pre-test	Poor	12	32.4
	Moderate	25	67.6
	Good	0	0.0
Intervention – Post-test	Poor	0	0.0
	Moderate	8	21.6
	Good	29	78.4
Control – Pre-test	Poor	9	24.3
	Moderate	28	75.7
	Good	0	0.0
Control – Post-test	Poor	8	21.6
	Moderate	28	70.3
	Good	1	2.7

Table 2 shows that, before the intervention, the intervention group was predominantly in the moderate knowledge category, with 25 participants (67.6%), while no participants were in the good category. The control group was also predominantly in the moderate category, with 28 participants (75.7%), and no participants were in the good category.

After the intervention, the knowledge distribution changed. In the intervention group, most participants were in the good category, with 29 participants (78.4%), while none were in the poor category. In the control group, most participants remained in the moderate category, with 28 participants (70.3%), while only one participant (2.7%) was in the good category

Table 3. Independent-samples t-test results

Variable	Mean	N	p-value
Post-test – Intervention group	11.32	37	0.000
Post-test – Control group	6.62	37	0.000

Table 3 shows that the mean pre-test knowledge score was 6.30 in the intervention group and 6.41 in the control group. The statistical analysis demonstrated that the post-test mean score in the intervention group (11.32) was higher than that in the control group (6.62), with a statistically significant difference ($p = 0.000$).

DISCUSSION

Based on the statistical analysis, interactive education using puzzle media significantly improved oral and dental health maintenance knowledge among third-grade students at MIN 27 Lambaro, Aceh Besar. The paired-samples t-test showed a significant increase in the intervention group, from a mean pre-test score of 6.30 to 11.32 on the post-test ($p = 0.001$, $p < 0.05$). Meanwhile, the independent-samples t-test indicated that there was no significant difference in knowledge between the intervention and control groups before the intervention ($p = 0.749$), whereas a significant difference was observed after the intervention ($p = 0.000$, $p < 0.05$). These findings indicate that puzzle-based education was more effective than the lecture method in improving oral and dental health maintenance knowledge.

The researchers suggest that puzzle-based education can improve students' knowledge because puzzle media creates an active, engaging, and enjoyable learning process that is consistent with the characteristics of elementary schoolchildren. Children may understand material more easily through visual media and play-based activities than through verbal explanations alone. Puzzle activities also directly involve students in the learning process, helping them remain focused and enthusiastic and making the oral health information easier to remember.

Active student participation during the learning process may be a key factor underlying the increase in knowledge in the intervention group. During the puzzle activity, students did not merely receive

information passively; they also thought, discussed, and collaborated with their peers. This made the learning process more meaningful and less monotonous than the lecture method. In the control group, the lecture method tended to involve students less actively, which may have reduced their attention and concentration during the learning process.

The findings are supported by (Hutami et al., 2019), who reported that dental health puzzle games were effective as an oral health education medium for elementary school students because they increased students' understanding and learning interest. The study indicated that puzzle media could facilitate the delivery of health information in a more engaging way, making the material easier for students to understand..

This study is also consistent with (Notoatmodjo, 2019), which states that knowledge is influenced by sensory processes involving the five senses, particularly sight and hearing. The use of puzzle media in oral health education incorporates visual elements and direct activities, making information easier for students to receive. In addition, learning theories for elementary schoolchildren suggest that children understand concrete materials more easily when they are delivered through engaging learning media. Therefore, puzzle media may be an effective approach for improving oral and dental health maintenance knowledge among third-grade students at MIN 27 Lambaro, Aceh Besar.

Other studies have reported similar findings. (Manggarsari et al., 2023)showed that health education using puzzle games improved dental caries knowledge among elementary school students. Likewise, reported that puzzle media could improve students' learning motivation and memory because learning was conducted interactively and enjoyably, explained that puzzle media helped students understand materials more quickly through a combination of images, colors, and assembly activities that were appropriate for elementary schoolchildren.

CONCLUSION

Based on the findings and discussion, interactive education using puzzle media significantly improved oral and dental health maintenance knowledge among third-grade students at MIN 27 Lambaro, Aceh Besar

DECLARATION OF CONFLICT OF INTEREST

The authors declare that the manuscript was prepared without any conflicts of interest involving the authors or other parties.

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