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Dental Puzzle-Based Little Dentist Training on Oral Health Promotion among Elementary School Students

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ABSTRACT

Oral and dental health problems among elementary school children remain prevalent and require innovative promotive–preventive approaches. This study aimed to improve knowledge, attitudes, and behaviors related to oral health through training of Little Dentists using dental puzzle media at SDN Mangkang Kulon 1, Semarang City. A total of 24 sixth-grade students participated on 4–5 August 2025. This study employed a pre-experimental design with a one-group pre-test and post-test approach, and participants were selected using purposive sampling. Methods included interactive education, group discussions, toothbrushing practice, dental puzzle games, and evaluation with pre- and post-test questionnaires. Data were analyzed using a paired t-test. Results showed significant improvements in knowledge ($p < 0.001$), attitudes ($p = 0.001$), and behaviors ($p = 0.005$) after the intervention. Dental puzzle media effectively engaged participants and facilitated active learning. These findings indicate that peer-led Little Dentist training with interactive media is an effective promotive–preventive strategy and has potential for sustainable integration into school-based Dental Health Programs (UKGS).

INTRODUCTION

Oral health is an essential component of overall well-being; however, oral health problems remain prevalent, largely due to limited public awareness and insufficient emphasis on early preventive efforts. This condition highlights the need for community-based educational initiatives that are introduced from an early age to support the development of healthy behaviours. According to the WHO Oral Health Country Profile, Indonesia demonstrates relatively high dental care expenditure compared to other countries in Southeast Asia, which may contribute to a considerable economic burden associated with treatment costs and productivity loss when preventive measures are not optimally implemented (Kemenkes RI, 2023a). Dental and oral health in Indonesia continues to represent a public health concern, as oral health problems persist across various age groups alongside suboptimal utilisation of dental health services at the community level (Liasari et al., 2024). These circumstances underscore the importance of strengthening dental and oral health literacy through early, innovative, and participatory educational strategies that engage children and the broader school community (Altaş et al., 2025).

Little Dentists are primary school students who are trained and empowered as a strategic group in promotive and preventive oral health efforts through a peer-led approach. In this role, they function as oral health literacy facilitators who support the dissemination of healthy dental and oral health practices among their peers (Elsadek et al., 2023). This target group is particularly relevant, as primary school–aged children are at a developmental stage that is vulnerable to dental caries. Data from the 2023 Indonesian Health Survey indicate that oral health problems remain prevalent among children aged 5–9 years and 10–14 years, with 49.9% and 37.2% of children, respectively, experiencing dental damage due to cavities or pain (Kemenkes RI, 2023b).

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Based on the 2024 Puskesmas Mangkang Profile, dental services in the area are provided by a single dentist serving a population of 16,789 people across three sub-districts. Most patients seeking care at the Puskesmas Mangkang present with advanced conditions, particularly tooth decay involving pulp and periodontal tissues. Data from the top ten dental and oral disease records at the Puskesmas Mangkang for the period of July 2024 to July 2025 indicate that pulp and supporting tissue disorders are more frequently reported than early-stage caries (UPTD Puskesmas Mangkang Kota Semarang, 2024). This pattern suggests that dental care utilisation tends to occur at a late stage, underscoring the need to strengthen promotive and preventive efforts. Community- and school-based oral health education is therefore essential to support earlier preventive actions and reduce the progression of dental problems into more severe conditions.

Government efforts to improve oral health among school-aged children have been implemented through the School Dental Health Programme (UKGS), which adopts a promotive–preventive approach to foster healthy behaviours from an early age (Thioritz et al., 2025). A key component of this programme is the empowerment of Little Dentists as peer-led agents who disseminate oral health messages within the school environment (Christiono et al., 2024). Peer-led approaches have been demonstrated to be effective in enhancing knowledge and supporting the development of positive oral hygiene practices among children (Failasufa Hayyu et al., 2023). Evidence from previous studies indicates that school-based oral health programmes, including UKGS, contribute meaningfully to improving children's oral health literacy and behaviours, reinforcing the importance of continuous and context-appropriate training for Little Dentists.

At the primary school level, children demonstrate strong learning receptivity when educational approaches align with their developmental stage, highlighting the need for oral health education methods that are engaging, interactive, and easily understood. Within the framework of the School Dental Health Programme (UKGS), innovative learning media such as dental puzzles offer a participatory approach that can enhance student involvement and comprehension of oral health messages (Rahmi et al., 2023). Interactive media not only supports knowledge acquisition but also facilitates positive attitudes and practical skill development through peer-based learning (Samjaji et al., 2024).

Despite the growing body of evidence on school-based oral health promotion and the effectiveness of peer-led approaches, several gaps remain. Previous studies have primarily focused on conventional educational methods or general interactive media, with limited attention to the use of specific game-based learning tools such as dental puzzles in the context of Little Dentist training. Furthermore, there is still a lack of evidence examining the combined impact of peer-led approaches and puzzle-based interactive media on improving knowledge, attitudes, and behaviours simultaneously among primary school children, particularly in community-based settings. Therefore, this study aimed to strengthen school-based oral health promotion by empowering Little Dentists through dental puzzle media to enhance student participation, peer-led learning, and the adoption of positive oral health practices within the working area of Puskesmas Mangkang, Semarang City.

METHOD

This study employed a quasi-experimental design with a one-group pre-test and post-test approach. This community service activity was conducted on 4–5 August 2025 in the working area of the Puskesmas Mangkang, Semarang City, targeting sixth-grade students of SDN Mangkang Kulon 1. The participants were Little Dentists, serving as peer-led oral health cadres aged 10–11 years, with a total of 24 respondents.

The selection criteria included students who demonstrated interest and motivation in health-related activities, the ability to participate in active learning, and cooperative and responsible attitudes. Priority was given to students with good communication skills, strong academic performance in Natural Sciences and Social Studies (IPAS), and active involvement or achievements in environmental, health, or sports activities. Teacher and school support, as well as students' willingness to participate in the full training and mentoring process, were also considered.

Community service activities were conducted following Ethical Clearance (EC) No. 078/KEPK-FKM/UNIMUS/2023 and implemented through several systematic stages, beginning with team formation and cross-sector coordination with the Puskesmas and the target school. At the initial stage, participants' knowledge, attitudes, and oral health behaviours were assessed using a structured pre-test questionnaire to establish baseline conditions prior to the intervention.

The measurement of participants' knowledge, attitudes, and oral health behaviours was conducted using a structured questionnaire developed through the adaptation of previously validated instruments. The knowledge component was adapted from a study assessing oral health knowledge among public school children, which included items related to tooth function, dental caries, oral hygiene practices, and preventive behaviours (Almalki et al., 2024). The attitude and behaviour components were adapted from the Oral Health Behavior Questionnaire based on the Health Belief Model (OHBQAHBM), which has been widely used to assess oral health-related perceptions and practices (Xiang et al., 2020). The questionnaire items were further modified to suit the cognitive level and comprehension of primary school children aged 10–11 years.

To ensure the validity and reliability of the instrument in the study context, the adapted questionnaire underwent content validation through expert judgment and was pilot-tested on a small group of students prior to implementation. Feedback obtained from the pilot test was used to refine the clarity, relevance, and comprehensibility of the questionnaire items before final data collection.

The educational and training phase for Little Dentists was delivered through interactive lectures, group discussions, and question-and-answer sessions, supported by dental puzzle media. The educational materials covered dental anatomy, stages of tooth development, proper toothbrushing techniques, caries prevention, healthy and unhealthy food choices for dental health, the role of nutrition in tooth development, and the importance of regular dental check-ups. Following the educational session, participants were divided into small groups and engaged in assembling dental puzzles for 10 minutes, followed by a 10-minute group discussion to reinforce key messages.

In addition to presenting the material, a demonstration of proper tooth brushing techniques using a dental phantom and toothbrush was conducted, followed by hands-on practice by participants under the guidance of facilitators. Participants' dental and oral health status was also examined using the WHO/SIAGAMU (Unimus Faculty of Dentistry Dental and Oral Health Data Information System) form, with the aim of providing an overview of participants' dental health and raising awareness of the importance of regular dental check-ups.

After completion of the programme, a post-test using the same questionnaire was administered to evaluate changes in participants' knowledge, attitudes, and oral health behaviours. Pre- and post-intervention scores were analysed using a paired *t*-test to assess statistical significance. Qualitative observations of participant engagement, responsiveness, and active participation were also documented to complement the quantitative findings and provide a comprehensive evaluation of the community-based oral health promotion programme.

RESULT

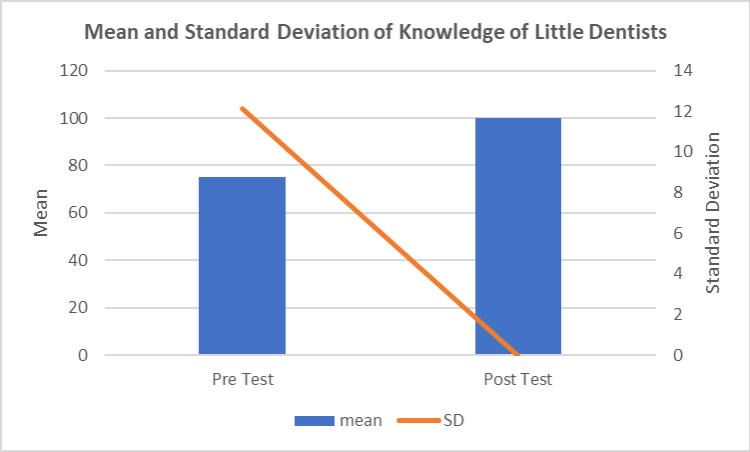

Figure 1. Mean and standard deviation of knowledge tested at the beginning and end of the training activity for Little Dentists

The analysis results show that the average knowledge score of participants before the intervention was 75.00 ± 12.16, which then increased to 100.00 ± 0.00 after the education was implemented. This

increase indicates a very significant improvement in knowledge, accompanied by a decrease in the variation in scores between participants with all participants achieving the maximum post-test score.

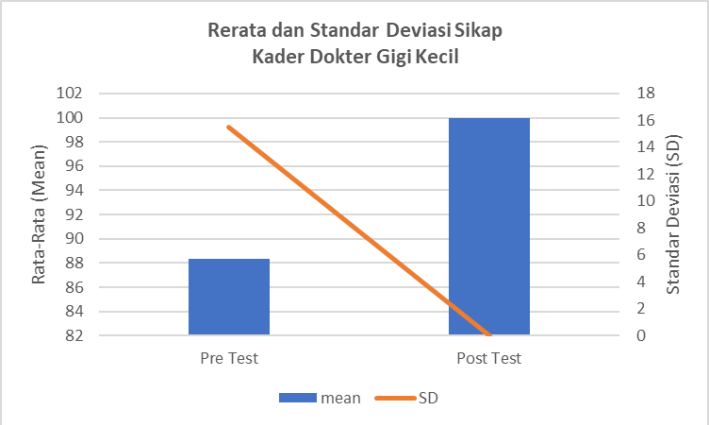

Figure 2. Mean and standard deviation of attitudes tested at the beginning and end of the Little Dentists training activity

The average attitude score of participants on the pre-test was 88.33 ± 15.51, and increased to 100.00 ± 0.00 on the post-test. These results indicate that after the intervention, all participants had a uniformly positive attitude towards maintaining dental and oral health, with no differences in scores between individuals.

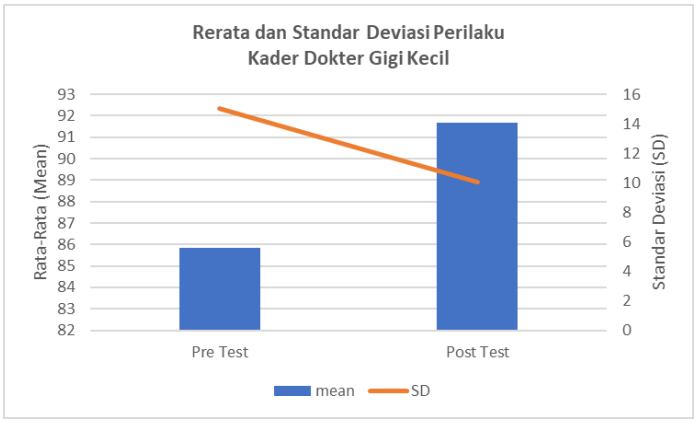

Figure 3. Mean and standard deviation of behaviour tested at the beginning and end of the Little Dentists training activity

In terms of behaviour, the pre-test mean score of 85.83 ± 15.01 increased to 91.67 ± 10.07 in the post-test. In addition to the increase in the mean score, there was also a decrease in the standard deviation, indicating a reduction in behavioural variation among participants after the education was provided. The more modest improvement observed in behavioural scores compared to knowledge and attitudes reflects the gradual nature of behaviour change, which often requires sustained reinforcement beyond a single intervention. These quantitative findings provide statistical support for the observed improvements following the educational intervention.

Table 1. Differences in Knowledge, Attitude, and Behaviour Scores Before and After Intervention

Variabel	Mean Pre-test ± SD	Mean Post-test ± SD	Mean Difference	t	df	Sig. (2-tailed)
Pengetahuan	75.00 ± 12.16	100.00 ± 0.00	25.00	-10.07	23	<0.001*
Sikap	88.33 ± 15.51	100.00 ± 0.00	11.67	-3.68	23	0.001*
Perilaku	85.83 ± 15.01	91.67 ± 10.07	5.83	-3.08	23	0.005*

Table 1 shows the results of the paired t-test, indicating that there were statistically significant differences between pre-test and post-test scores for all measured variables. The greatest improvement

occurred in the knowledge variable ($p < 0.001$), followed by attitude ($p = 0.001$) and behaviour ($p = 0.005$). These findings indicate that the educational intervention provided was effective in increasing knowledge, forming positive attitudes, and encouraging changes in oral health behaviour among participants.

DISCUSSION



(a) (b) (c)

Figure 4. Distribution (a) randomly (b) little dentists begin working (c) dental puzzle arrangement

The improvement in participants' knowledge, attitudes, and behaviours indicates that the promotive preventive educational approach through the training of Little Dentists using dental puzzle media is effective in enhancing both understanding and oral health practices. This effectiveness can be explained by the nature of puzzle media as an active learning tool that integrates visual, motor, and cognitive processes, allowing participants to construct knowledge through direct engagement rather than passive reception. Such multimodal stimulation is particularly important for school aged children, as it facilitates the transformation of abstract concepts, such as the process of caries formation and proper toothbrushing techniques, into more concrete and meaningful learning experiences. These findings are consistent with the research by (Widiani et al., 2025) and (Ulliana et al., 2025), which confirm that interactive educational media can improve dental health knowledge in school-age children. In addition, recent studies have shown that interactive and multimedia-based oral health education significantly enhances knowledge retention and comprehension compared to conventional lecture-based methods, as it promotes active participation and deeper cognitive processing among learners (Lekaram et al., 2025; Panna et al., 2026)



(a) (b) (c)

Figure 5. Dental Puzzle (a) design and materials (b) completion (c) simulation and discussion



Figure 6. Group photo after the implementation of the little dentist training activity

The observed improvements in attitudes and behaviours following the intervention indicate that the educational program extended beyond mere knowledge acquisition, fostering the internalisation of health-related values and the development of sustained healthy practices. This suggests that the intervention was not only effective at the cognitive level but also influenced the affective and behavioural domains, which are essential for long term habit formation. The use of interactive and participatory learning methods, such as dental puzzle activities and peer involvement through the Little Dentists model, likely contributed to this outcome by encouraging active engagement, social interaction, and experiential learning. These findings suggest that periodic reinforcement and integration into routine school health activities may be necessary to sustain behavioural changes over time. This is in line with the concept of health promotion, which places behavioural change as the main outcome of public health interventions. Research by (Restiningsih & Anggraeni, 2024) and (Mardiah et al., 2025) also supports the use of interactive educational media to improve toothbrushing skills and motivation to have regular dental check-up. In addition, recent studies have highlighted that interactive school based oral health education can significantly influence children's oral hygiene behaviours by promoting active participation and strengthening behavioural intentions (Al-Hassan et al., 2025; Bayraktar Nahir et al., 2025).

During the activity, participants demonstrated high levels of engagement, as reflected in their enthusiasm, active participation in discussions, and involvement in the preparation and simulation of dental puzzles. This level of engagement suggests that the learning environment successfully facilitated student centred and experiential learning, which are known to enhance both motivation and cognitive processing. The puzzle media functioned not only as a visual aid but also as a participatory learning tool that stimulated concentration, problem solving, and critical thinking skills through hands on activities and collaborative interaction. Such interactive learning experiences are particularly effective for children, as they encourage active involvement and sustained attention compared to passive instructional methods. This reinforces the findings of (Pay et al., 2023), who stated that puzzle media are effective in increasing student participation and interaction in the learning process. Furthermore, recent studies have also shown that game based and interactive educational media can improve student engagement and learning outcomes in oral health education by fostering a more dynamic and enjoyable learning atmosphere (Sitalaksmi et al., 2024; Yulistina et al., 2025).

This study demonstrates that promotive preventive education using dental puzzle media was associated with improvements in knowledge, attitudes, and oral health related behaviours among participants. The observed changes suggest that interactive educational approaches may support the internalisation of positive oral health values and encourage healthier practices. From a practical and public health perspective, these findings indicate that training Little Dentists using dental puzzle media is a feasible and context appropriate strategy for school based oral health promotion, particularly in areas with limited access to dental health services such as the working area of Puskesmas Mangkang. By empowering students

as peer educators, this approach strengthens the role of schools as entry points for preventive oral health efforts and supports task sharing within primary health care services, with potential for further development and wider implementation. Similar studies have also highlighted that school based oral health promotion programmes using interactive methods can contribute to improving children's oral hygiene status and reducing the risk of dental diseases in the long term (Bayraktar Nahir et al., 2025; Hosseini et al., 2025).

Despite these positive findings, this study has several limitations. The use of a one group pre test and post test design without a control group limits the ability to establish causal relationships. In addition, the relatively small sample size and the short duration of the intervention may affect the generalisability and sustainability of the observed behavioural changes. Therefore, future studies are recommended to employ more rigorous experimental designs with larger sample sizes and longer follow up periods to better evaluate the long term effectiveness of interactive and peer led oral health education interventions.

CONCLUSION

Little Dentist training using dental puzzle media was associated with improvements in primary school students' oral health knowledge, attitudes, and behaviours. Interactive and participatory learning approaches may enhance the effectiveness of school based oral health promotion, particularly through peer-based empowerment strategies within the School Dental Health Program.

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