



Pop-Up Book About Motivation to Brush Their Teeth for Students of SDN 01 Bandar Buat of Padang City

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Track Record Article	Abstract
Revised: 18 July 2026 Accepted: 19 September 2026 Published: 29 September 2026 How to cite : Rahmad, Y., & Jannah, W. S. (2026). Pop-Up Book About Motivation to Brush Their Teeth for Students of SDN 01 Bandar Buat of Padang City. <i>Contagion: Scientific Periodical Journal of Public Health and Coastal Health</i>, 8(3), 576–586.	<i>Caries is a common dental health problem among elementary school children. At the Lubuk Kilangan Community Health Center, 1,625 cases were found out of 5,260 children examined, one of the causes being low motivation to brush their teeth. Interactive pop-up books, as a three-dimensional visual medium, can be an alternative to increase children's interest and motivation in maintaining dental health. To determine the effectiveness of interactive pop-up books on tooth brushing motivation among students of SDN 01 Bandar Buat, Padang City. The research design used a one-group pretest–posttest design. The study sample consisted of 91 students selected using purposive sampling techniques. Data were collected using questionnaires before and after the intervention. Univariate data analysis was presented in the form of frequency distributions and percentages, and bivariate analysis used the Wilcoxon test using IBM SPSS Version 23 software. The study showed an increase in students' toothbrushing motivation after being given an interactive pop-up book intervention. The Wilcoxon test results showed a significant difference between the level of toothbrushing motivation before and after the intervention ($p < 0.05$). Conclusion: The use of pop-up book media is effective in increasing toothbrushing motivation in second-grade students of SDN 01 Bandar Buat, Padang City.</i> Keywords: <i>Effectiveness, Pop-Up Book, Interactive, Motivation, Brushing Teeth.</i>

INTRODUCTION

Caries is a common problem faced by elementary school students. Children's teeth, especially those of elementary school age, are a combination of primary and permanent teeth. This mixed dental arrangement makes them more susceptible to caries. This condition may be related to students' dental health care practices, which are influenced by individual and external factors. Dental caries in elementary school students is a problem that requires special attention because it can reflect the effectiveness of dental health care efforts (Setyaningsih et al., 2023).

The 2023 Indonesian Health Survey (SKI) showed that dental caries is the most common oral health problem, with an incidence rate of 82.8%. This is especially true for children aged 5-9, where the caries rate is even higher, reaching 84.8%. Meanwhile, a 2018 report from the Padang City Ministry of Health recorded a caries rate of approximately 36.71% lower than the provincial average for the same period (Aristiyanto et al. 2023).

Oral and dental health care is a crucial aspect of maintaining a healthy body. Furthermore, maintaining oral hygiene is an essential form of self-care, as this organ plays a crucial role in preventing the entry and growth of pathogenic bacteria that can cause various serious diseases (Syahdia et al. 2024). Good oral care standards include brushing your teeth at least twice a day and thoroughly cleaning the entire oral cavity, including the tongue, to prevent the buildup of food debris that can lead to tooth decay and other health problems. (Pitaloka, 2019).

Toothbrushing behavior in children is characterized by a lack of support for proper brushing practices. Support or motivation is a key element in encouraging more regular and correct brushing behavior. Conversely, children with low levels of motivation often exhibit suboptimal brushing behavior. Strong encouragement plays a role in fostering more positive brushing behavior. Toothbrushing behavior in children (Wanti, Mintjelungan, and Wowor 2021). Psychologically, encouragement or motivation is a key element that encourages the formation of more regular and appropriate tooth brushing behavior. Within this framework, according to *Self-Determination Theory* (SDT), fostering children's motivation to adopt healthy behaviors requires fulfilling basic psychological needs for a sense of competence and autonomy. However, conventional health education methods are often ineffective due to the limited attention span of children aged 7-8 years. Based on *Optimal Stimulus Theory* (Yerkes-Dodson Law), the learning process in children requires attractive visual stimulation that is appropriate to their stage of cognitive development. Interactive pop-up book media is presented as a dynamic three-dimensional visual learning medium and contains kinetic elements, so it can simplify complex health information, stimulate interest, and minimize children's boredom.

Innovation in learning media plays a crucial role in improving the quality of education. Educational media has the ability to overcome the physical limitations of learning spaces. In the health context, the use of promotional media serves as a strategic method for conveying information, allowing communicators to increase audience understanding, thereby impacting constructive behavior change. (Lestari et al., 2023).

Pop-up books have been shown to improve cognitive and behavioral aspects related to dental health in children. This is proven by research conducted by (Haryani and Siregar 2022) that Pop-up books can significantly improve toothbrushing skills in slow-learning children compared to hand puppets. The use of pop-up books also has the advantage of helping children increase their knowledge and motivation to maintain dental and oral health. (Widodorini et al. 2023) In their study, it was found that 3-dimensional pop-up storybooks improved first-grade students' knowledge, attitudes, and behavior regarding toothbrushing patterns and significantly reduced DMFT and OHI-S scores.

Pop-up books are a type of learning media consisting of books with three-dimensional elements. The material is presented through engaging visual illustrations, with components that change shape or move as the pages turn. The uniqueness of this medium lies in its ability to display images that change shape, move, or have a pop-up effect as the pages turn. This interactive visual presentation successfully stimulates interest and fosters enthusiasm in children. As a medium that presents information in a three-dimensional and dynamic format, pop-up books also provide an engaging learning experience while minimizing boredom. (Maryani, 2022).

Pop-up media can be used as an innovative and relevant educational option, focusing on this research. Pop-up books allow for a more engaging presentation of story material through three-dimensional visualization and kinetic elements, thus resembling the shape of real objects. This uniqueness makes the learning experience more engaging and dynamic. (Roja et al. 2022) Oral health education for children from an early age is crucial. The goal of health education and the use of pop-up books is expected to motivate students during their growth and development to pay more attention to general and dental health. It also aims to encourage individual behavioral changes, particularly in toothbrushing skills that can train patience, thoroughness, and regular habits in taking the time to clean teeth properly, so that children can actively contribute to achieving a caries-free state. (Mukhlisoh, 2023).

Based on data from the Padang City Health Office in 2023-2024 regarding dental and oral health management, the Lubuk Kilangan Community Health Center had the highest prevalence of dental caries cases, namely 1,625 cases of caries from 5,260 students examined at the elementary/junior high school level (Health Office 2023). The results of health screening data at the Lubuk Kilangan Community Health Center, Padang City, on elementary school students in the 2024-2025 academic year showed that the highest caries prevalence was at SDN 01 Bandar Buat, Padang City. Of the 626 students examined, there were 322 students who had dental caries. Further screening revealed that the highest prevalence was in first-grade students of SDN 01 Bandar Buat, namely 80 out of 114 students had dental caries. Based on the above background, the purpose of this study was to identify the level of tooth brushing motivation of students at SDN 01 Bandar Buat, Padang City before the use of interactive pop-up books. Another objective is to identify the level of tooth brushing motivation of students at SDN 01 Bandar Buat, Padang City after using interactive pop-up books and to analyze the differences in the level of tooth brushing motivation of students at SDN 01 Bandar Buat, Padang City before and after being given education using pop-up book media.

METHOD

This study used a quantitative research method with a single-group pretest–posttest pre-experimental design. This design aimed to determine the effectiveness of providing an interactive pop-up book on students' motivation to brush their teeth by comparing the respondents' conditions before and after the intervention. In this design, the researchers used only one group without a control group, so measurements were conducted twice on the same group, namely before (pretest) and after (posttest) the intervention was administered.

The population in this study was all students of SDN 01 Bandar Buat, Padang City, totaling 117. The research sample consisted of 91 students, selected using purposive sampling, which is a sampling technique based on specific criteria set by the researcher. These criteria are adjusted to the research objectives so that the samples taken can represent the characteristics needed in the study. Inclusion criteria: (1) second-grade students WHO are actively registered at SDN 01 Bandar Buat, (2) able to read and communicate well, and (3) fully present during *the pretest*, intervention, and *posttest processes*. Exclusion criteria include students who were absent during the intervention. or have not completed the questionnaire in full.

Data collection was conducted using a toothbrushing motivation questionnaire that had been tested for validity and reliability. The questionnaire was administered to respondents before the intervention to measure their initial level of motivation in brushing their teeth (pretest). Next, respondents were given an intervention in the form of dental and oral health education using an interactive pop-up book. After the intervention was completed, the same questionnaire was administered again to measure changes in their level of motivation in brushing their teeth (posttest).

The research instrument was a toothbrushing motivation questionnaire consisting of 20 items with a 4-point Likert scale. The instrument was adapted from a specific questionnaire, so it appeared to be designed specifically for this study and had undergone validity and reliability testing. The questionnaire covered aspects of toothbrushing desire and intention, regularity, internal motivation, independence, learning interest, perceived benefits, barriers, and anxiety about dental care, but was not formally divided into motivational subdomains. All 20 items were found to be valid, with a Cronbach's Alpha of 0.929 in the pretest and 0.946 in the posttest. The mean motivation score increased from 63.62 to 78.42 after the intervention, and the Wilcoxon test showed a significant difference ($p = 0.000$).

Toothbrushing motivation is defined as students' encouragement to brush their teeth correctly and regularly. Motivation was measured using a questionnaire consisting of 20 statements with a 4-point Likert scale: strongly agree, agree, somewhat agree, and disagree.

Statements consisted of favorable and unfavorable items with a score range of 1–4. The total score ranged from 20–80 and was converted into a percentage. Motivation was categorized as low (0–33%), sufficient (34–66%), and high (67–100%). Measurements were conducted before (pretest) and after (posttest) the interactive pop-up book intervention.

The intervention used an interactive pop-up book containing materials on oral health and proper tooth brushing techniques. Prior to the intervention, respondents were given a pretest to assess their toothbrushing motivation. Furthermore, they were educated using the interactive pop-up book, and then reassessed using a posttest questionnaire after the intervention was completed. The study used a one-group pretest-posttest design, meaning measurements were taken at only two points in time: before and after the intervention. Long-term follow-up was not conducted.

Ethical approval was obtained prior to the study. The Research Ethics Committee Approval Letter from the Health Research Ethics Committee of the Faculty of Dentistry, Baiturrahmah University, No. A.79/KEPKFKGUNBRAH/XI/2025. The letter stated that the study was declared ethically sound (ethical exemption).

The data obtained were analyzed using univariate and bivariate analyses. Univariate analysis was used to describe the characteristics of respondents and the distribution of toothbrushing motivation levels in the form of frequencies and percentages. Meanwhile, bivariate analysis was conducted to determine differences in toothbrushing motivation levels before and after the intervention using the Wilcoxon test using IBM SPSS Version 23 software, used the Wilcoxon test using IBM SPSS Version 23 software, because the data obtained were ordinal and not normally distributed. The results of the analysis were then used to assess the effectiveness of the interactive pop-up book in increasing students' toothbrushing motivation.

RESULTS

Table 1. Frequency Distribution of Respondents Based on Gender and Age

Respondent Characteristics	F	%
Man	45	49.5
Woman	46	50.5
Age (years)	F	%
7 years	27	29.7
8 years	64	70.3
Total	91	100%

Based on data from Table 1, the frequency distribution of the 91 respondents included 45 male students (49.5%) and 46 female students (50.5%). This means the number of respondents was relatively balanced between men and women; thus there was no gender

dominance in this study.

Based on age, the majority of respondents were 8 years old, namely 64 students (70.3%), while 27 students were 7 years old (29.7%). This aligns with the characteristics of second-grade elementary school students, who are generally around 7-8 years old.

Table 2. Descriptive Statistics of Tooth Brushing Motivation Pre-test and Post-test

Motivation to Brush Your Teeth	F	Minimum	Maximum	Means	Standard Deviation
<i>Pre-test</i>	91	60	70	63.62	2.112
<i>Posttest</i>	91	73	80	78.42	1,898

Table 2 presents the results of a descriptive statistical analysis of students' levels of toothbrushing motivation before (pretest) and after (posttest) the interactive pop-up book intervention. The parameters displayed include minimum, maximum, mean, and standard deviation values.

The table shows that the average posttest score for toothbrushing motivation was higher than the pretest. This indicates an increase in students' toothbrushing motivation after receiving oral health education using interactive pop-up books. Furthermore, the minimum and maximum scores on the posttest also increased, indicating that increased motivation occurred among the majority of respondents, not just a select group.

The standard deviation of the post-intervention t-test results tended to show smaller variations in scores compared to pre-intervention, indicating that students' motivation levels after the intervention became more even. Overall, these descriptive statistical results indicate that the use of interactive pop-up books has a positive impact on increasing students' motivation to brush their teeth, which is further strengthened by the results of the inferential statistical tests in the following table.

Table 3. Results of Wilcoxon Test Analysis

The Effectiveness of Pop-Up Books in Triggering Interactive Toothbrushing Motivation	Means	Sig.	Information
<i>Pre-test</i>	63.62	0.000	H ₁ accepted
<i>Post-test</i>	78.42		

There was a significant difference between the pretest and posttest scores, thus concluding that the intervention was effective in improving respondents' measurement results. This improvement is supported by the frequency distribution, where all respondents in the posttest achieved a score of ≥ 73 , while in the pretest, most respondents still scored ≤ 64 . Thus, the results of the statistical analysis and overall frequency distribution show that the intervention provided was able to increase respondents' scores, both descriptively and inferentially.

However, although respondents' motivation levels remained categorically high, further analysis of motivation scores revealed a significant increase between the pretest and posttest. This was evidenced by the increase in the average score. Motivation scores increased from 63.62 in the pretest to 78.42 in the posttest, supported by a Wilcoxon test. The test results showed a statistically significant difference. Thus, the interactive pop-up book intervention did not change motivation categories, but played a role in increasing the intensity or strength of students' motivation in the high category.

significance test which showed a p value = 0.000 ($p < 0.05$), an effect size analysis was conducted to determine the practical significance of the pop-up book intervention. interactive effect on tooth brushing motivation. Based on the Wilcoxon test statistic ($Z = -8.304$) with $N = 91$, an effect size value of $r = 0.87$ (or $r = 0.62$ based on the total number of observation pairs) was obtained. Referring to Cohen's criteria (where $r \geq 0.50$ is categorized as a large effect), *this value indicates that the pop-up book media intervention has a very strong/large effect in practically increasing students' motivation to brush their teeth, not just statistically significant.*

DISCUSSION

The findings of this study indicate that pop-up book media-based dental and oral health education interventions provide a significant shift in tooth brushing motivation in elementary school-aged children. The high effect size confirms that this intervention is not only inferentially meaningful but also has strong practical significance in shifting students' motivational intensity to an optimal level. This transformation indicates the effective reception of promotional messages through visual- kinetic stimulation, which changes the perception of tooth brushing from a tedious obligation to an engaging and enjoyable activity.

The success of this media can be explained by its suitability for the cognitive developmental stage of children aged 7–8 years (the concrete operational stage). At this age, children have a limited attention span and have difficulty processing abstract verbal instructions commonly delivered in conventional lecture methods. The integration of three-dimensional (3D) elements, moving folding mechanical components, and visual *surprise elements* stimulates the five senses simultaneously. Psychologically, this mechanism aligns with *Optimal Stimulation Theory* (Mustofa et al., 2022), where dynamic yet structured visual stimulation triggers attention and interest in learning at peak capacity. Furthermore, when viewed from *Self-Determination Theory* (Butler 2002), children's physical involvement in flipping and exploring books fulfills basic psychological needs for *autonomy* and competence, thereby fostering an intrinsic drive to maintain oral hygiene independently without coercion.

The results of this study reinforce the findings of previous studies evaluating the

effectiveness of three-dimensional interactive media in the domain of child health promotion. A study by Widodorini et al. (2023) found that the use of 3D pop-up storybooks simultaneously improved knowledge and attitudes, as well as improved toothbrushing behavior in elementary school students. Similar findings were reported by Lestari et al. (2023) and Rahayu et al. (2025), where pop-up media proved superior to flat media (leaflets) in improving psychomotor skills. However, there are differences in the focus of this study and those studies. (Lestari et al., 2023; Safitri et al., 2025). While Widodorini et al. (2023) and Wildani (2023) focused on cognitive and affective domains and decreased clinical parameters (such as the OHI-S and DMFT indices), this study specifically focuses on the dynamics of strengthening children's internal motivation as the primary driving *force* before behavior is formed (Widodorini et al., 2023; Wildani, 2023). Furthermore, this study complements the research of Haryani & Siregar (2022) and Mukhlisoh (2023), which demonstrated the superiority of pop-up books over hand puppets in special populations, by demonstrating that similar media are also highly adaptive and effective in the general elementary school student population. (Haryani & Siregar, 2022; Mukhlisoh, 2023)

Clinically and practically, this surge in motivation is an important indicator in the School Dental Health Program (UKGS) preventive program. Given the high prevalence of caries in children in the local community health center's work area, a child-friendly educational approach that can foster the initiative to brush teeth regularly (morning after breakfast and night before bed) is an essential primary preventive strategy to break the chain of plaque formation and dental caries from an early age.

Research Limitations (Study Limitations)

Despite showing strong intervention impacts, interpretation and generalization of the findings of this study must take into account several methodological and contextual limitations: First, the use of a *one-group pretest -posttest design* without an active control group (such as a comparison group with educational lectures or leaflets) limits the ability to eliminate external confounding variables and maturation bias. Furthermore, post - test measurements conducted immediately after the intervention was *completed* in a single session were not able to assess long-term motivation retention (*novelty effect*) or the sustainability of that motivation in students' daily behavior. Another limitation lies in the study's focus, which exclusively measured psychological variables (motivation) through questionnaires, without directly assessing toothbrushing skills (psychomotor) or evaluating clinical indicators of oral health, such as scores. index OHI-S plaque or caries status.

In addition, data collection based on a Likert scale questionnaire on second-grade

children (aged 7–8 years) is susceptible to self *-report bias* and *social desirability bias*, where respondents tend to choose normative answers that please the researcher. Finally, the limited sample coverage of second-grade students in one elementary school in Padang City through a *purposive sampling technique* requires caution in extrapolating. These findings apply to populations with different demographic backgrounds and age groups.

This study has several methodological limitations, including: (1) Using a one-group pretest-posttest design without a comparison control group; (2) Motivation evaluation was conducted immediately after the intervention (immediate evaluation), so it did not assess long-term motivation retention; (3) Measurement only focused on motivational aspects without assessing psychomotor skills of tooth brushing and clinical indicators of dental hygiene (OHI-S/plaque); and (4) Questionnaire-based data collection in second-grade children is susceptible to self-reporting bias (social desirability bias).

CONCLUSION

This research provides significant scientific and practical contributions by empirically proving that pop-up book educational media, an interactive approach, was highly effective in significantly increasing toothbrushing motivation in second-grade students at SDN 01 Bandar Buat, Padang City, with a large effect size. The success of this intervention confirms that a concrete and kinetic three-dimensional educational approach can bridge the concentration limitations of 7–8-year-old children while simultaneously stimulating their intrinsic motivation to maintain dental and oral health.

In practice, these findings open up a real opportunity to reform the School Dental Health Program (UKGS) and community health center services, shifting from conventional lecture-based instruction to more engaging, visual- interactive learning. In real-world applications, pop-up books are recommended to be integrated as a standard module in mass toothbrushing activities in elementary schools, a child-friendly educational tool in the waiting room of a community health center dental clinic, and a medium for promoting independent oral hygiene habits in the family environment without coercion. As a follow-up, future researchers are advised to strengthen this evidence through long-term studies based on control groups and measuring real clinical indicators such as a decrease in the index. plaque and dental caries.

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