ORIGINAL ARTICLE

# Effectiveness of the dento activity book on preschool children's dental health knowledge: a quasi-experimental study

Dwi Kurniawati[1]*
Della Kusumawati Lupianto[2]
Morita Sari[1]
Septriyani Kaswindiarti[3]

[1]Department of dental public health, Faculty of Dentistry, Universitas Muhammadiyah Surakarta, Indonesia
[2]Undergraduate student, Faculty of Dentistry, Universitas Muhammadiyah Surakarta, Indonesia
[3]Department of pediatric dentistry, Faculty of Dentistry, Universitas Muhammadiyah Surakarta, Indonesia

*Correspondence:
dwi.kurniawati@ums.ac.id

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## ABSTRACT

**Introduction:** Poor dental health in early childhood is a significant concern. Data from the 2023 Indonesian Health Survey indicates that the prevalence of dental and oral problems among the population aged 3 years and older reached 56.9%, with a large proportion being caries. One of the contributing factors is knowledge. Education is essential for enhancing awareness and understanding. To aid understanding, various media are employed. The Dento Activity Book serves as an educational tool, designed as an activity book to teach children about dental and oral health. This study aimed to analyze the effectiveness of the Dento Activity Book in improving preschool children's dental knowledge. **Methods:** This research utilized a quasi-experimental design that features a pre-post test with a non-equivalent control group. A total of 46 children from Permata Hati Islamic Kindergarten were selected as participants. Knowledge was assessed through a structured interview administered before and after the educational intervention. The data were analyzed using the Mann-Whitney U test. **Results:** The average knowledge score for the treatment group increased by 1.96, while the control group saw an increase of 0.30, yielding a significant value of 0.00 ($p<0.05$). **Conclusion:** The Dento Activity Book effectively enhances preschool children's understanding of how to maintain their dental and oral health.

## KEYWORDS

Dento activity book, education, knowledge, preschool

## INTRODUCTION

Preschool is a vital stage in the growth and physical development of children. This period, often referred to as the critical period, is when children begin to form habits that are likely to persist into adulthood.[1] One important habit is the maintenance of dental and oral health.[2] According to the 2023 Indonesian Health Survey (SKI), 56.9% of the population aged 3 years and older have dental and oral problems. Dental examinations conducted during the 2023 SKI revealed a high prevalence of dental caries at 82.8%. In addition, 84.8% of young children aged 5-9 years were found to have experienced caries, or cavities. This means that only 15.2% of children in Indonesia are free from dental caries.[3]

Preschool children are particularly vulnerable to tooth decay because the enamel layer of their primary teeth is still developing after they erupt.[4] Several factors contribute to tooth decay, which can be categorized into primary and

supporting factors. The primary factors include cariogenic bacteria, fermented carbohydrates (substrates), the host, and time. Supporting factors encompass family background, oral health awareness and attitudes, oral health beliefs, and oral health-related behavior, knowledge, and social support.[5,6,7] An individual's dental and oral health can improve when positive dental and oral health behaviors are present, which are fostered through sound knowledge and positive attitudes toward dental and oral health.[8]

Education is a highly effective method for enhancing knowledge about dental and oral health maintenance in preschool children. Dental and oral health education is crucial for facilitating behavior change.[9] Health education initiatives significantly influence individual behavioral characteristics, such as oral health knowledge, attitudes, practices, dietary habits, incidence of tooth decay, periodontal health, and overall oral hygiene.[10] The importance of implementing dental and oral health education as early as possible for preschool children is to prevent an increase in dental caries, which could lead to permanent damage to the teeth of school-aged children.[11] Early awareness is vital for effectively maintaining dental and oral health and can begin in preschool, particularly for children aged 4-6 years.[12,13] At this developmental stage, children tend to be more active, creative, and imaginative.[14]

Dental and oral health education requires the use of media to enhance understanding. The selection of media should be tailored to the characteristics of the target audience and should incorporate engaging learning materials that are appealing to children. Various types of media can be utilized for educational purposes, including print media, electronic media, and outdoor media.[15] Several studies have demonstrated how interactive print media can effectively enhance kindergarten children's understanding of dental and oral health. This includes tools such as flashcards, puzzles, pop-up books, and board games. Several studies related to interactive print media have been added.[16,17,18,19,20]

Each of these media has its advantages and limitations. Flashcards, enhancing memory, are practical, and effective for teaching basic concepts; however, they do not support motor skills and lack opportunities for in-depth exploration.[16]mPuzzles can foster cognitive development, problem-solving abilities, and fine motor skills, but the educational message they convey may not be explicit, and the variety of materials can be limited.[17] Pop-up books serve as multisensory learning tools that improve information retention and encourage independent exploration. Nevertheless, they require special design and complex printing techniques, which can lead to relatively high production costs and constraints on material development.[18] Board games can boost children's motivation and engagement, develop motor skills, and enhance experiential learning. However, they necessitate dedicated playtime, require special preparation to set up equipment (such as boards, cards, and pawns), and typically involve multiple players.[19,20]

To address these limitations, this study introduces the Dento Activity Book, a game-based interactive print media specifically designed for children aged 4 to 6 years. This activity book focuses on enhancing motor skills and is intended for individual use. It is not restricted by time or location and does not require any special preparation. The activities are organized in stages, progressing from simple to more complex tasks, and include repetitive exercises to reinforce understanding and skill development. Additionally, it provides tangible results that can be observed through the worksheets, allowing for the evaluation of a child's progress. The Dento Activity Book is specifically designed to enhance children's understanding of dental and oral health. It provides information about dental caries, including its causes, effects, and prevention strategies.[21]

This print-based book features educational content and activities presented alongside colorful and engaging images. Tailored for preschoolers,

it emphasizes skill-related activities such as coloring, matching and circling pictures, thickening lines, counting, sticking, and cutting on each page, all in an engaging format. The learning approach is centered on the idea of learning through play, which makes the experience enjoyable and interactive.[22] This method resonates with preschoolers, who are naturally inclined to play, possess high levels of curiosity, are imaginative, learn from their surroundings, and develop cognitive skills.

These strategies not only support children's character and behavioral development but also enhance their understanding of dental and oral health.[23] Unlike commonly used educational tools, the Dento Activity Book employs a structured learning approach through play and is culturally adapted for Indonesian preschoolers. This innovative design offers a practical, engaging, and developmentally appropriate resource for improving oral health knowledge in early childhood. Consequently, this study aims to analyze the effectiveness of the Dento Activity Book in enhancing dental knowledge among preschool children.

## METHODS

The research utilized a quasi-experimental design that included a pre-post test with a non-equivalent control group. The study was conducted at Permata Hati Islamic Kindergarten in Surakarta. The kindergarten was chosen based on a pre-research survey indicating that 75% of the children had dental caries. Additionally, the kindergarten had not received dental health education in the past three years. The teachers expressed a willingness to supervise and guide the children in completing the Dento Activity Book.

A total of 46 children from Permata Hati Islamic Kindergarten Surakarta were selected for the sample using a purposive sampling technique. The sample size was determined using the Noether formula with power 0.8. Inclusion criteria for the study consisted of children aged 5 to 6 years who had obtained permission from their parents or guardians and children who fully participated in the research process. Children who were uncooperative or had special needs were excluded from the study.

We assessed the knowledge variable through structured interviews that utilized an observation sheet. Observation sheet that underwent validity and reliability testing. The validity testing involved 30 children from Al Islam 10 Kindergarten in Surakarta. The results from the Pearson product moment correlation indicated that each item had a calculated r value greater than the r table (0.361), which signifies that the items are valid. For the reliability test, Cronbach's alpha was used, yielding a value of 0.736, which exceeds the threshold of 0.700. Therefore, it can be concluded that the statements are fairly reliable. Observation sheet consists of 10 questions covering four domains: dental caries, its causes, effects, and preventive measures.[24,25,26] The evaluation of the observation sheet was based on the number of correct responses, with correct answers receiving a score of 1 and incorrect answers receiving a score of 0.

The research began with the development of the Dento Activity Book (Figure 1), designed to enhance children's understanding of dental and oral health. This includes the definition, causes, and effects of dental caries, as well as methods of prevention. The Dento Activity Book was developed through consultations with experts in pediatric dentistry, health promotion, and early childhood education to ensure its appropriateness for children's developmental stage. Content validity was evaluated using the Content Validity Index (CVI). The aspects assessed include content appropriateness, suitability for child development, alignment with learning objectives, language clarity, and design elements (graphics, layout, illustrations). A 4-point Likert scale was employed for evaluation (1 = irrelevant, 2 = somewhat relevant, 3 = relevant, 4 = very

relevant). Two aspects received an I-CVI value of 0.67, which is below the acceptable threshold of 0.78, specifically in the area of language and design.

Consequently, improvements were made based on expert feedback, focusing on language simplification and enhancing illustration clarity. After these adjustments, the I-CVI value increased to 1.00. Following this, a small-scale trial was conducted involving five kindergarten children. The Dento Activity Book has been copyrighted under number EC00202418953. Supervision and guidance were provided by teachers, coordinated by the researchers.


**Figure 1**. Dento activity book

The sample was divided into two groups: the treatment group and the control group. The treatment group received education using the Dento Activity Book, while the control group received education through lectures by teachers. Initial knowledge assessments took place prior to the educational intervention, with both teachers and researchers present. The researcher read the questions individually and documented the responses on an observational sheet. The educational program took place every day for 7 days, assisted by teachers, and final knowledge measurements were conducted on the 8th day. The collected data were analyzed using the Mann-Whitney U-test. This test was selected to evaluate the differences in pre- and post-test results between the two groups, as the data did not follow a normal distribution.

## RESULTS

We conducted this research in January 2024. The study's results showed that most respondents were male and 6 years old (see Table 1). A total of 46 participants were divided into two groups: 23 in the treatment group and 23 in the control group. Table 2 displays the average knowledge values for both groups before (pretest) and after (posttest) the intervention. As shown in Table 2, both groups experienced an increase in their average knowledge values,

with the treatment group demonstrating a more significant increase compared to the control group.

**Table 1. Participant characteristic**

| Participant | N | % |
|---|---|---|
| Age | | |
| 5 year | 18 | 39.1 |
| 6 year | 28 | 60.9 |
| Sex | | |
| Male | 29 | 63 |
| Female | 17 | 37 |

**Table 2. Difference in mean knowledge before and after intervention**

| | Treatment group | | Control group | |
|---|---|---|---|---|
| | Mean±SD | Mean Difference | Mean±SD | Mean Difference |
| Pretest | 6.61±1.53 | 1.96 | 5.83±1.58 | 0.30 |
| Posttest | 8.56±1.24 | | 6.13±1.66 | |

Table 3 outlines the differences in average knowledge based on gender. According to the table, the most significant increase was observed among females in both the treatment and control groups. Females in the treatment group demonstrated a larger difference in average knowledge compared to those in the control group.

**Table 3. Difference in mean of dental knowledge based on gender**

| Knowledge | N | Mean±SD |
|---|---|---|
| **Treatment group** | | |
| Male | 14 | 1.78±1.31 |
| Female | 9 | 2.22±1.39 |
| **Control group** | | |
| Male | 15 | 0.26±1.28 |
| Female | 8 | 0.37±1.18 |

Table 4 displays the frequency distribution of correct answers obtained from the knowledge structured interviews, which employed an observation sheet. The data indicate that both groups experienced an increase in knowledge following the intervention. In the treatment group, the most significant increase in knowledge scores was noted for the items: "The best time to brush your teeth is while taking a shower" and "Visit your dentist every six months for check-ups." In contrast, the control group showed the highest increase in knowledge scores for the item "Eating too much candy may lead to unhealthy teeth."

The results of the Shapiro-Wilk normality test indicated that the data was not normally distributed (Table 5), which led to the use of the Mann-Whitney test. The Mann-Whitney test results revealed a significance value of 0.00 ($p<0.05$), indicating a significant difference between the treatment group (Dento Activity Book) and the control group (education without the Dento Activity Book) (see Table 6).

**Table 4. Frequency distribution of to dental knowledge**

| Questionnaire items | Treatment group | | | Control group | | |
|---|---|---|---|---|---|---|
| | Pretest N (%) | Posttest N(%) | Difference | Pretest N(%) | Posttest N (%) | Difference |
| Cavities are damaged teeth. | 21 (91.3) | 22 (95.7) | 1 | 18 (78.3) | 16 (69.6) | 2 |
| Tooth decay cause teeth to turn black | 16 (69.6) | 21 (91.3) | 5 | 17 (73.9) | 14 (60.9) | 3 |
| Eating too much candy may lead to unhealthy teeth | 10 (43.5) | 21 (91.3) | 11 | 8 (34.8) | 21 (91.3) | 13 |
| Consuming chocolate every day can contribute to tooth decay | 20 (87) | 22 (95.7) | 12 | 21 (91.3) | 23 (100) | 2 |
| Tooth decay can result in pain | 21 (91.3) | 22 (95.7) | 1 | 19 (82.6) | 22 (95.7) | 3 |
| Tooth decay cause bad breath | 20 (87) | 19 (82.6) | 1 | 11 (47.8) | 9 (39.1) | 2 |
| Tooth decay may lead to a loss of appetite | 16 (69.6) | 17 (73.9) | 1 | 12 (52.2) | 10 (43.5) | 2 |
| *The correct way to brush your teeth is when bathing | 4 (17.4) | 18 (78.3) | 14 | 1 (4.3) | 10 (43.5) | 9 |
| Visit your dentist every six months for check-up | 7 (30.4) | 21 (91.3) | 14 | 12 (52.2) | 10 (43.5) | 2 |
| Eating fruit can help prevent tooth decay | 17 (73.9) | 14 (60.9) | 3 | 15 (65.2) | 6 (26.1) | 9 |

*Negative statement

**Table 5. Test of normality**

| | Group | Statistic | Df | Sig |
|---|---|---|---|---|
| Difference between pre- and post-knowledge scores | Treatment group | 0.843 | 23 | 0.002 |
| | Control group | 0.900 | 23 | 0.025 |

If Sig. > 0.05, then the data is considered normally distributed.

**Table 6. *Mann-Whitney Test***

| | Group | N | Mean Rank | Sum of Ranks | Z | Sig. |
|---|---|---|---|---|---|---|
| Knowledge | Treatment | 23 | 31.20 | 717.50 | | |
| | Control | 23 | 15.80 | 363.50 | -3.987 | 0.00* |
| | Total | 46 | | | | |

* p<0.05

## DISCUSSION

The period from preschool to elementary school is particularly vulnerable for tooth decay, as children often fail to maintain good dental and oral health habits. This issue stems from a lack of knowledge, which serves as the root cause of many dental problems in preschool children.[27]

This study examined a sample of children aged 5 to 6 years, with the highest frequency distribution observed in 6-year-olds (60.9%) (see Table 1). This aligns with previous research that involved respondents who were pre-school children aged 5 to 6 years, as they tend to possess better communication skills than younger children. [28,29] The choice of creative media for preschoolers is tailored to their individual characteristics. At this developmental stage, children's cognitive abilities begin to progress to the concrete operational level, enabling them to understand symbols.[30] Children at this age typically enjoy engaging in active play and hands-on activities.[31]

The results of the study indicated an increase in knowledge for both the treatment and control groups, with the treatment group showing the greatest enhancement (Table 2). Previous research has shown similar results, indicating

that the improvement in the treatment group was greater than that in the control group.[32] The use of activity book media was found to improve cognitive abilities, foster the development of various intellectual potentials, and boost learning motivation. Learning motivation plays a significant role in knowledge mastery.[33] The incorporation of creative media facilitates more effective learning activities and enhances learning performance in alignment with the desired educational outcomes.[34,35]

In this study, girls in both the treatment and control groups demonstrated a greater average increase in knowledge compared to boys (see Table 3). This finding aligns with previous research indicating that women score higher in knowledge assessments compared to men.[36] Knowledge is influenced by gender, with girls exhibiting better knowledge and academic abilities than boys. This tendency may be attributed to girls being more attentive and diligent in their studies; however, boys often excel in fields such as technology.[37] Additionally, girls typically have more time available for reading.[38]

The study results detail the frequency distribution of correct answers for each item in the pretest and posttest knowledge questionnaires within the treatment group (Table 4). Both children and parents expressed the belief that they only visited the dentist when they were ill.[39] Parental involvement in maintaining children's dental health, along with parental habits, can significantly influence children's oral health. The risk factors associated with early caries in children indicate that parents hold primary responsibility. They must oversee the quality and consistency of their children's personal hygiene, assist them in developing practical dental care skills, and ensure that they use tools and hygiene products correctly to effectively remove dental deposits.[40,41]

The pretest and posttest knowledge questionnaire items in the control group that showed the largest difference were related to the question, "Eating too much candy may lead to unhealthy teeth," with a value of 13. This is backed by earlier studies indicating that a diet high in sugary foods may elevate the risk of dental caries.[42] The significant difference in correct scores for this question can be attributed to the parenting habits of parents who frequently give candy to their children. Parents, particularly mothers, play a crucial role in making decisions about health-related practices and creating an environment that fosters healthy behaviors.[43] Some questions showed a decrease in the number of correct answers in the control group after the intervention. This may be attributed to factors such as limited concentration, fatigue, and boredom with the method employed.

Preschool children, defined as those aged between 4 and 6 years, are in a crucial developmental stage. During this golden period, they begin to cultivate knowledge, skills, and behaviors that will establish a foundation for future learning. Children in this age group tend to learn through play and interactions with their environment. They possess significant potential for growth if provided with opportunities for motor activities appropriate to their developmental stage. To ensure optimal growth in preschool children, it is essential to offer stimuli that promote development across all aspects of their growth.[44]

Dental health education for children is an important health initiative aimed at enhancing their knowledge, willingness, and skills in maintaining dental and oral hygiene.[45] Educational media serves as a valuable tool to foster thinking, feelings, attention, and interest.[46] For children, visual educational media can significantly enhance learning activities.[47] The selection of creative media for preschool children is adjusted to the child's character. One educational resource that can be utilized is the Dento Activity Book.

This interactive book includes educational content and activities, making it a valuable learning tool as well as an enjoyable game for children. The Dento Activity Book is engaging for children, facilitating their understanding of dental and oral health. This study employed the Dento Activity Book, which covers the

definition of dental caries, its causes, effects, and prevention strategies, with the aim of enhancing children's knowledge about maintaining dental and oral health.

The study's results indicated an increase in knowledge for both the treatment and control groups. Notably, the treatment group exhibited a greater improvement in knowledge compared to the control group (Table 6). The Mann-Whitney test results yielded a p-value of 0.000 ($p<0.05$), indicating a significant difference in knowledge between the two groups. Thus, it can be concluded that the Dento Activity Book effectively enhances preschool children's dental health knowledge. Dento activity books serve as interactive educational media. This is consistent with prior research indicating that interactive media effectively enhances children's knowledge.[16,17,18,19,20]

The Dento Activity Book is a printed resource developed from the original Activity Book, specifically focusing on dental and oral health. It contains information about understanding dental caries, including its causes, effects, and prevention strategies.[14] As a learning tool, the Dento Activity Book is classified as print-based graphic media and visual media. This book is filled with pictures and offers various activities aimed at making learning enjoyable for children.[48] Activities within the book include coloring, pasting, outlining, circling, bolding, and cutting, all presented in attractive colors designed to capture children's attention.

The book is tailored for preschool children and aims to enhance their knowledge of dental and oral health through a playful approach. This is in line with previous research which stated that the use of interactive media, such as digital games, educational applications, and technology-based approaches, is effective in increasing children's understanding and involvement in learning about dental health.[49] Play is a crucial aspect of children's growth and development, providing opportunities for them to understand their surroundings, interact with peers, express emotions, and develop self-control, while also fostering symbolic abilities that encourage active knowledge building.[50] Activity book media can boost learning motivation. This motivation significantly impacts knowledge mastery.[48] Furthermore, the use of creative media facilitates more effective learning activities and improves learning performance in line with the desired outcomes.[35]

The Dento Activity Book offers several advantages that support various aspects of children's development. This is in line with previous research findings which show that the use of interactive media in early childhood learning, such as pop-up books, flash cards, and board games, is effective in increasing children's engagement and understanding.[16,17,18,19,20] For kindergarten children, interactive media should be engaging, featuring colorful illustrations and simple language, and should be activity-based to enhance engagement and retention.[51] Dento activity book serves as an interactive, creative, and innovative medium designed to meet their learning needs. This approach encourages children to actively seek information while enhancing their reading skills, which are essential for improving comprehension.[23] The book's format makes it safer and more durable for children to use. Additionally, its larger size makes it user-friendly.

The Dento Activity Book can be utilized both in group settings and individually, and it is engaging due to its inclusion of pictures, animations, and bright colors. This is in line with previous research which states that interactive visual-based learning media, such as animation, illustrations, and color elements, can develop children's cognitive abilities and increase children's engagement in the learning process.[52] Moreover, it aids in developing children's fine motor skills as they engage in activities with stationery. The improvement in knowledge among preschool children after using the Dento Activity Book is attributed to the repeated and gradual nature of the activities. Such repetition fosters conditioning and helps establish habits. As a result, the learning process

involves transforming input into information that is then processed, described, and stored in memory. The disadvantages of the Dento Activity Book media include the fact that it can be boring if it features too many repetitive images and unattractive colors. Although the Dento Activity Book follows the principle of age-appropriate learning, it fails to effectively stimulate the child's growth and development. Therefore, additional activities or media are necessary to aid in the child's developmental stimulation.[32]

This study offers significant insights into the efficacy of the Dento Activity Book in enhancing oral health knowledge among preschool children. However, it possesses several limitations. First, the study employed a non-probability sampling technique, commonly used in educational and community-based interventions. This method has been extensively utilized in prior research on child health education; however, it possesses limitations concerning sample representativeness and the generalizability of the findings.[53,54] Thus, the results may not apply to all preschoolers. They are most relevant to groups similar to the study sample. Second, as is typical in many quasi-experimental studies conducted in natural school settings, complete control over external influences could not be achieved. Previous research has confirmed that quasi-experimental designs are vulnerable to bias stemming from uncontrolled external variables, such as the learning environment and the teacher's role.[55]

Nevertheless, efforts were made to maintain consistency across groups and to minimize potential confounding factor. Third, the evaluation relied on structured responses appropriate for preschool-aged children, which may introduce some variability. This is in line with what other studies have found that measuring young children is often affected by their cognitive development, attention, and communication skills.[56,57] However, using age-appropriate instruments helps ensure that the data accurately reflect the children's understanding. Overall, despite these contextual factors, this study provides evidence that supports the effectiveness of interactive educational media in enhancing children's oral health.

## CONCLUSION

This study concludes that education using the Dento Activity Book effectively enhances preschool children's dental health knowledge. The implication of the study is that educational tools based on activities can enhance or complement traditional oral health education. In practical implication, dentists can utilize this book as an interactive educational tool to encourage oral health behaviors among children. Additionally, teachers can integrate this book into health-themed learning activities that align with the concept of healthy schools. Further research is recommended to investigate long-term retention, behavioral changes, and parental involvement.

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**Data Availability Statement:** Data supporting the findings of this study, including links to publicly archived datasets analyzed or generated, are available upon request.

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