

Evaluating the effect of dental explosion boxes on oral health awareness in preschoolers

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Abstract

Many children experienced anxiety during their initial dental visits, often fearing medical equipment and the procedures they would undergo. The Dental Explosion Box served as an alternative approach to enhance oral health awareness and functioned as an educational tool integrated with a game. This study aimed to assess the effectiveness of the Dental Explosion Box in introducing oral health concepts to early childhood. This research employed a pre-experimental design featuring a one-group pre-test and post-test approach. Sampling relied on the purposive sampling technique, with the sample size determined using the Isaac and Michael formula, resulting in a cohort of 25 preschool students. Variables examined in this study encompassed the Dental Explosion Box and Oral health Awareness. Oral health awareness in preschool children was measured using a checklist of questions. The Dental Explosion Box had undergone rigorous testing and had been endorsed by media and material experts. The study's hypotheses were tested using the Wilcoxon Sign Rank Test. The average pre-intervention oral health introduction score was 6.68, while the post-intervention score increased to 11.00. Analysis through the Wilcoxon Sign Rank Test revealed a significant difference (p-value of 0.000, <0.05) between the level of oral health awareness in early childhood before and after receiving intervention with the Dental Explosion Box. The findings from this study highlighted the effectiveness of the Dental Explosion Box in introducing oral health concepts to early childhood. It enhanced children's familiarity with oral health and motivated them to regularly visit the dentist.

Introduction

Early recognition and dental care are highly important, especially considering the substantial number of children with a relatively high def-t index, many of whom have not received proper treatment. It has been reported that the global prevalence of caries in children ranges from 23.8% to 57.3% among all children aged 0-6 years worldwide. Research in Mexico indicates that dental caries affects 20-70% of children under 6 years of age. Similarly, in developed countries like England, the prevalence of dental caries among 5-year-old children is approximately 40-60%.¹ Research by the Basic Health Research (2018) indicates a very high prevalence of caries in early childhood (90.1%), with only 9.9% of children being free from dental problems such as cavities.² According to the Indonesia Basic Health Survey (2013), there was a 28.9% increase in dental and oral health problems among children aged 5-9 years and a 25.2% increase among those

aged 10-14 years. Efforts to maintain oral health should commence early, particularly during elementary school, which is an ideal time for practicing motor skills in children.³ Efforts to maintain the overall health of children, including factors related to dental and oral health, are of paramount importance in supporting the growth and development of children. Oral health can affect the well-being, abilities, and competence of a child, and it can also affect the child's overall physical health.⁴⁻⁶ Therefore, it is essential to begin preventive measures for dental cavities early on. One of the prevalent oral health issues in Indonesia today is tooth loss. Several treatments can be undertaken to address these problems, particularly to restore the function of missing teeth, including mastication, speech function, and aesthetic improvement.⁷

The American Dental Association and the American Academy of Pediatrics mention that regular check-ups with a dentist every 6 months are highly recommended to detect dental and oral problems as early as possible. Children should be taken to a doctor or dental clinic before they reach one year of age or before their first baby teeth emerge.⁸ In Ismau's study (2019), an overview of routine oral health checks for school-age children was provided. Out of 150 samples, only 41 students, or approximately 27.33%, regularly checked their teeth with a dentist, while 109 students, or about 72.66%, did not undergo routine dental check-up.⁹ The fear experienced by children can influence their behavior and, in turn, may determine the success of their visit to the dentist. Introduction to the world of dental health can begin during a visit to the dentist at the age of 18 months, with treatment being carried out at the age of 2-3 years. During the visit, the child is introduced to dentists, dental nurses, the examination room's facilities and infrastructure, as well as the situations that may occur during dental treatment.¹⁰⁻¹⁴

One of the efforts to introduce the concept of dental health can be achieved through the use of educational media. Learning media utilized in early childhood education should be capable of enhancing children's enthusiasm, such as interactive toys. The Dental Explosion Box comprises various educational sections combined with games to make learning engaging for children. The components of the Dental Explosion Box can serve as a creative and innovative knowledge medium for introducing oral health to children.¹⁵⁻¹⁷ The advantages of using the Explosion Box as supplementary media in dental education include its ability to make students enthusiastic and eager to interact, as well as its capacity to facilitate students' comprehension of the learning material.

Research results from Sari *et al.* (2020) indicated differences in learning outcomes when using the Explosion Magic Box, with an average pre-test score of 61.06 increasing to 85.95.¹⁸ Santoso *et al.* (2021) suggest that a media promotion model, the Teeth Box Explosion, is effective in bringing about changes in tooth brushing behavior in elementary school students.¹⁹ Based on research by Syarief *et al.* (2021), it can be observed that there is a change in the level of knowledge regarding vegetables and fruit when using the Explosion Box media. Students' memory is more focused on visual objects and images as compared to written content and images in PowerPoint or slides.²⁰ The difference in this research lies in the fact that the respondents were at a very young age, and the type of explosion book was more specific, focusing on the world of dental health. The research aimed to analyze the effectiveness of the Dental Explosion Box as a medium for introducing the concept of oral health to young children, which can serve as study material to encourage young children to undergo regular check-ups at oral health service facilities.

Materials and Methods

Research design

This research is a pre-experimental study with a one-group pre-test and post-test design. The research sample consisted of dental toddler boarding school students in March 2023.

Study participants

The sample size was determined using the formula developed by Isaac and Michael, with a 5% error rate.²¹ The inclusion criteria encompass children aged 4 to 6 years who are registered as preschool students, while the exclusion criteria pertain to preschool children with special conditions that may influence the results. The sample calculations yielded a total of 25 preschool students.

Variable, instrument and data collection

Primary data were obtained through research instruments in the form of checklists and the Dental Explosion Box (Figure 1). The measurement of students' awareness of oral health was conducted using a checklist of questions. The data collection process was assisted by the toddlers' teacher to ensure that the language used was easier for the students to understand. The assessment of the level of recognition before and after the intervention involved assigning a numerical code to the checklist sheet: correct answers were given a value of 1, while incorrect answers were given a value of 0. The assessment results were grouped into three categories: i) High awareness = 12-18, ii) Moderate awareness = 6-12, and iii) Low awareness = 0-6.

The Dental Explosion Box consists of five components. The first component introduces oral health workers in clinics. The second component provides an introduction to dental clinic infrastructure. The third component introduces dental examination tools. The fourth component includes tools for examining and maintaining oral health. The fifth component models good and bad oral habits. Regarding the media and materials used in the Dental Explosion Box, the materials have undergone feasibility testing by media and material experts, utilizing the media and material feasibility test presentation formula. The eligibility categories are based on the following criteria: i) < 21% = very unsuitable, ii) 21-40% = not feasible, iii) 41-60% = somewhat feasible, iv) 61-80% = feasible, and v) 81-100% = very suitable. The assessment of the diligence results by three material experts and three media experts in this study obtained a score of 87%, indicating that it was highly suitable for use.



Figure 1. Dental Explosion Box Introduction to the Oral health.

Data analysis

The data in this study were analyzed using the Wilcoxon Sign Rank Test, with a significance level of $p < 0.05$. If the probability value is < 0.05 , the hypothesis is accepted, indicating that the Dental Explosion Box can increase preschool children’s awareness of oral health.

Ethical clearance

The research has received ethical approval from the Health Research Ethics Commission, a team at the Bandung Health Polytechnic, based on ethical certificate No. 39/KEPK/EC/III/2023. During the research, the researcher adhered to ethical principles, including obtaining informed consent, respecting human rights, and ensuring beneficence and non-maleficence.

Results

This study analyzes the effectiveness of the Dental Explosion Box in introducing oral health to preschool children. The research was conducted with 25 early preschool children in one of the preschool areas.

Table 1 displays the characteristics of the respondents based on age and gender. The most common age is 6 years, with a total of 11 people (44%), and the predominant gender is female, with a total of 15 people (60%).

Table 2 presents the level of awareness of oral health before using the Dental Explosion Box, with boys having a recognition level of 20.0% and girls at 6.6%. After receiving counseling on oral health using the Dental Explosion Box, both boys and girls achieved a 100% recognition level.

The recognition scores of early childhood related to oral health using the Dental Explosion Box are provided in the form of descriptive statistical data values, with the measurement results as follows.

Table 3 displays a total of 25 samples of children’s recognition scores related to oral health. The recognition scores prior to receiving treatment varied between a minimum of 4 and a maximum of 9. The pre-introduction score data had an average of 6.6800 and a standard deviation of 1.2819. Following treatment using the Dental Explosion Box, recognition scores ranged from a minimum of 9 to a maximum of 12. Post-treatment recognition score data had an average of 11.000 and a standard deviation of 0.7071. The smaller standard deviation values in both data sets indicate that the measurements are consistent, with no data deviating significantly from the average.

The Wilcoxon Sign Rank Test was used to analyze the effectiveness of introducing the Dental Explosion Box to oral health. Table 4 displays the p-value ($0.000 < 0.05$), leading to the conclusion that there are differences in pre- and post-scores for the introduction to the world of oral health. The data scores indicate an improvement in the introduction of oral health to preschool children.

Table 1. The characteristics of the respondents include the age and sex of the child.

Categorical	Frequency	Percentage (%)
Age		
4 years	7	28
5 years	7	28
6 years	11	44
Gender		
Male	10	40
Female	15	60
Total	25	100

Table 2. Level of awareness of the oral health based on gender of preschool childrens before and after intervention using Dental Explosion Box.

	Not awareness (%)		Awareness level		Awareness (%)	
	Pre	Post	Enough awareness (%) Pre	Post	Pre	Post
Gender						
Male	2 (20)	0 (0)	8 (80)	0 (0) 0 (0)	10 (100)	
Female	1 (6.6)	0 (0)	12 (80)	0 (0)2 (13.4)	15 (100)	
Total	3	0	20	0 2	25	

Table 3. Results of the average the oral health recognition score.

	N	Minimum	Maximum	Mean	Std. Deviation
Score Pre-test	25	4.00	9.00	6.6800	1.2819
Score Post-test	25	9.00	12.00	11.000	0.7071

Table 4. Effectiveness Dental Explosion Box introducing the oral health.

	N	Mean	Std. Deviation	Z	p	Remarks
Score Pre-test	25	6.680000	1.281926	-4.413912	0.000	Significant test (Significant)
Score Post-test	25	11.000000	0.707107			

Discussion

Oral health care for children from an early age is important because children are in a period of growth and development. Dental health is closely related to the physical and psychological development of children. Maintaining awareness of dental and oral health can help prevent issues and provide treatment as needed.²² Tooth decay is the most common issue in children compared to other dental and oral diseases. One way to address this is by taking children to dental health care facilities, with the hope that regular dental checkups will help children become accustomed to them, reducing anxiety and fear related to dental and oral care.²³⁻²⁵ The child's first visit to the dentist is crucial for motivating them to continue with dental treatment. During this initial visit, it's best to introduce your child to the dental examination process and demonstrate that it can be a pleasant experience.²⁶⁻²⁸ Dental health workers typically aim to establish a connection with children before examining their teeth. This bond is essential to ensure the child's cooperation during treatment.²⁹

The results of this study indicate the level of introduction to oral health in preschool children before and after intervention using the Dental Explosion Box. It shows that girls gain awareness of oral health more quickly (Table 1). According to their perception, female students tend to have greater motivation in recognizing an object than male students. This is because boys often prefer unstructured outdoor activities, and they are more dependent on physical space rather than time. Boys design their games, and during play, they rely more on visual skills than verbal ones, with language use primarily limited to task completion.

This research on the Dental Explosion Box is designed to provide an overview of dental and oral health. Dioramas and interior models within the Dental Explosion Box consist of representations of a healthcare team, dental health service settings, dental tools, dental treatment processes, and methods for maintaining oral health. The Dental Explosion Box includes various educational sections integrated with games to make it engaging for children. The instructional Dental Explosion Box offers a variety of learning activities to prevent boredom and encourages students to participate in activities beyond simply listening to the teacher, including observing, doing, and presenting. According to the results of Daniati *et al.*'s research in 2020, the game component within the Explosion Box media serves as a creative and innovative knowledge medium.¹⁷ According to Wijayanti *et al.* (2020), the Explosion Box learning media is created with the aim of helping students understand the material in a more enjoyable way.³⁰

The research results in Table 3 show that the use of dental explosion media can increase preschool children's awareness of oral health. The selection of the Dental Explosion Box as a method to introduce oral health makes it easier for students to learn about the dental care process, including how to maintain oral health behaviors. The results of this study align with the research conducted by Santoso *et al.* in 2021, which demonstrates that the Dental Explosion Box is an effective medium for promoting oral health and changing tooth brushing behavior in school-age children, as compared to flashcards.¹⁹ The Dental Explosion Box offers the benefit of enhancing the maintenance of oral health in children, increasing their self-awareness, making children more conscious of how to properly and correctly care for their teeth, providing a high-quality and creative play experience for children, and developing children's fine motor skills to remember how to brush their teeth correctly and effectively.³¹

The Dental Explosion Box can enhance logical thinking abili-

ties in preschool children, making it a suitable medium for early childhood education. An interactive and effective Dental Explosion can have a positive effect on children, leading to changes in their knowledge, attitudes, and behaviors in a positive direction. Using an interactive and efficient Dental Explosion Box is highly appropriate for delivering lessons. Interactive engagement with the Dental Explosion Box can stimulate a child's curiosity and promote the development of logical thinking skills. When teaching early childhood, methods that provide holistic situations and relate them to oral health models should present materials that are relevant to the characteristics and needs of children. Learning that mirrors real-life situations will pique children's curiosity, and incorporating play activities in an engaging and colorful manner is essential.

The results of this study are supported by the research conducted by Fitriana & Chandrawati in 2016, which demonstrated the effective use of games in the field of dental health as a learning tool for early childhood dental health, including an introduction to dental caries.³² Additionally, research conducted by Humaira *et al.* in 2023 regarding the development of the smart dental box media illustrates an improvement in the maintenance of dental and oral health in children aged 5-6 years after receiving an intervention.³³

The Dental Explosion Box provides variations in learning activities to prevent boredom and encourages students to engage in activities beyond just listening to the teacher, such as observing, participating, and presenting. The Dental Explosion Box can assist the dental health team in educating children about oral health. In addition to being a learning tool, the Dental Explosion Box also clarifies the meaning of the subject matter through visuals.

Health workers and parents have a role in efforts to introduce oral health to children.³⁴ Insufficient knowledge and understanding of oral health among less supportive parents can result in poor dental and oral health maintenance behaviors in six-year-old children (Golden Age).^{35,36} Providing educational stimulation aims to support the growth and development of children, both physically and spiritually, so that they are prepared for further education. Early childhood learning should focus on imparting meaningful basic concepts to children through real experiences, allowing them to engage in activities and curiosity optimally.³⁷

Early childhood can easily absorb experiences about oral health through concrete (real) objects. Introduction to the world of oral health using the Dental Explosion Book is the most effective way to develop children's abilities optimally. When facilitated optimally, indoor play activities with the Dental Explosion Book are important for the holistic development of children, encompassing physical, emotional, mental, intellectual, creative, and social aspects. The limitation of this research is that when explaining the contents of the explosion box, preschool children's concentration can be easily distracted. Therefore, it is necessary to provide assistance from the teacher in explaining it in a way that children can understand.

Conclusions

Dental explosion boxes can be an effective tool in increasing preschool children's understanding of the importance of oral health care. Children become more familiar with oral health, and they are motivated to routinely visit the dentist.

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