

Design of the Interactive Activity Book “Let's Brush Our Teeth!” as an Innovative Approach to Dental Health Education for Children Aged 2–6 in Collaboration with Fransiskus Leo Dental Clinic in Medan

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Dental health problems in early childhood remain relatively high, especially among children aged 2-6 years, indicating a low level of awareness about the importance of maintaining oral hygiene from an early age. At this stage, children tend to learn more effectively through visual media and play-based activities, making interactive and engaging educational media essential. This study aims to design an interactive activity book as a learning medium for dental health that is appropriate for early childhood characteristics. The method used is design thinking, which consists of empathize, define, ideate, prototype, and test stages. The result of this study is an interactive book featuring cartoon illustrations, bright colors, and various interactive elements such as flaps, sliding, pull tabs, and matching activities. This book not only helps children understand the importance of dental care but also encourages parental involvement in the learning process. The testing results show that this media can increase children's interest and engagement in learning. Therefore, this interactive activity book can serve as an effective alternative educational medium to support the development of good dental care habits from an early age.

Keywords: Dental Health, Early Childhood, Educational Media, Interactive Activity Book.

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1. Introduction

Dental health among children aged 2–6 years remains a serious issue that requires special attention. Data from the 2018 Riskesdas survey indicate that approximately 93% of Indonesian children have dental caries, while in the city of Medan, the prevalence of caries among young children also remains high (Medan Health Department, 2022). This situation underscores the importance of early dental health education as a preventive measure.

Tooth caries not only causes pain and discomfort but also has the potential to lead to serious infections that can affect a child's overall health, including brain development and cognitive function (L. Angelova et al., 2023). The high prevalence of caries in primary and permanent teeth indicates that dental health issues among children remain very high both globally and nationally (Yufitri Mayasari., 2021). Impacts such as sleep disturbances, difficulty eating, and reduced concentration due to caries can also hinder a child's growth and development (M. Foláyan et al., 2023).

Various preventive measures have been implemented, such as encouraging regular toothbrushing, routine checkups, and educating parents. However, the educational methods used tend to be conventional and less engaging for children (S. Sharma et al., 2021). Furthermore, although dental health education can improve children's understanding, the incidence of dental caries has not yet shown a significant decline (Nendika Dyah Ayu Murika Sari et al., 2023).

Children aged 2–6 years are at a developmental stage where they are more receptive to learning through play and visual interaction. Therefore, physical educational materials such as interactive activity books are considered more appropriate because they are safe to use and can stimulate children's motor, cognitive, and social development (Tri Novianty Mansyur et al., 2022; Edy Arizul Handika et al., 2025).

Given these circumstances, this study developed an interactive activity book on dental health as a learning tool that combines educational elements with games. The book features interactive activities such as picture matching and simple games to make the learning process more enjoyable and easier for children to understand. In addition to helping children understand the importance of maintaining good dental health from an early age, this tool also involves parents in guiding the learning process, with the aim of fostering healthy lifestyle habits in children.

2. Theoretical Framework

A literature review is a study of the literature drawn from relevant books, journals, and scientific publications to establish a conceptual foundation for the design of instructional media (U. E. Chigbu et al., 2023). Early childhood development is influenced by sensorimotor activities and play. Physical or non-digital games provide learning experiences through body movement, hand-eye coordination, and sensory stimulation (Shanshan Lyu et al., 2025). These activities help children understand the concept of oral health through interactive activities such as matching pictures and recognizing good oral hygiene habits. Research shows that physical learning materials can improve children's fine motor skills, problem-solving abilities, and social interactions (Sri Dewi Arianti et al., 2024). In addition, physical play also encourages communication and collaboration between children and their parents or peers (M. Garaigordobil et al., 2022). The use of physical media is considered healthier because it reduces exposure to digital screens, making it an effective tool for early childhood education (Neng Nurcahyati Sinulingga et al., 2025).

Color plays an important role in capturing children's attention and shaping their emotional state. According to color psychology theory, color can influence children's feelings and focus while learning (Ashwini Nair et al., 2022). In the design of this interactive activity book, bright colors such as yellow, light blue, pink, and green were used to create a fun learning environment. Yellow symbolizes cheerfulness and a passion for learning; light blue conveys a sense of calm; pink creates a soft and friendly impression; while green represents cleanliness and health (Domicelè Jonauskaitė, 2025; E. Gibson, 2017). Young children also tend to prefer bright colors over dark ones because they are easier for children's developing visual systems to recognize (D. Eşian et al., 2024).

Illustrations serve as a visual medium that helps children understand information without lengthy text (Baratz Lea., 2024). The use of illustrations in educational materials can also enhance their appeal, stimulate children's interest in reading, and improve their understanding of the material presented (Andika Guruh Saputra et al., 2022). The illustration style suitable for children aged 2–6 typically consists of simple cartoon-style illustrations with bright colors and expressive characters. This visual approach fosters a sense of joy and emotional connection between children and the educational materials. Therefore, the illustrations in the book are designed using soft, simple, and child-friendly shapes.

Visual elements in educational media serve both as a means of conveying information and as an aesthetic enhancement. Their design is based on a child-centered approach to ensure they are appropriate for young children. The typography is kept simple, clear, and easy to read, while Gestalt principles are applied to help children understand the relationships between visual elements in a more structured way. In addition, visual storytelling is used to convey information step by step through illustrations and activities, making the learning process more effective and easier for children to understand.

Interactive activity books are learning materials that combine reading, play, and exploration through activities such as opening flaps, matching pictures, and sliding objects (Pompeo Vagliani, 2025). Interactive

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elements such as flaps and pop-ups can enhance the reading experience and children's emotional engagement in the learning process (Hikmah et al., 2024). Such interactions help children engage both physically and cognitively, making the delivery of information more effective. Supporting materials are used to increase children's interest and engagement in learning (A. Wulandari et al., 2023). In this design, supplementary materials were used in the form of children's toothbrushes with attractive designs, as well as crocheted keychains shaped like healthy and decayed teeth, to serve as visual aids to help children understand the importance of maintaining dental health from an early age.

3. Method

This study employs a quantitative approach based on statistical data from patients at Dr. Fransiskus Leo's Clinic over the past five years. The data were grouped into the following age ranges: 2–6 years, 7–19 years, 20–35 years, and 36–55 years, to determine the distribution of the number and percentage of patients in each age category. Data analysis was conducted to obtain an objective picture of the proportion of patients by age group. The results of the analysis show that the 2–6-year-old age group accounts for approximately 5–6% of the total each year. Although this number is relatively small compared to other age groups, young children remain the focus of the study because they are in a critical phase for developing good oral hygiene habits. A lack of early dental care can increase the risk of tooth decay and cause prolonged pain, which can potentially interfere with a child's comfort, concentration, and learning activities. Given these circumstances, this study focuses on developing visual learning materials in the form of interactive activity books as educational toys for young children.

Table 1. Patient Composition by Age Group and Percentage of Patients Aged 2–6 Years at the Fransiskus Leo Dental Clinic, 2020–2024

Year	2-6 Year	7-19 Year	20-35 Year	36-55 Year	Total Patients	Percentage
2020	46	210	332	234	822	5,60%
2021	47	228	347	249	871	5,39%
2022	51	240	358	264	913	5,59%
2023	53	252	380	271	956	5,54%
2024	56	266	398	283	1003	5,8%

Based on Table 2.1, the distribution of patients at the Fransiskus Leo Dental Clinic is dominated by the 20–35 age group, while the 2–6 age group has the smallest percentage, at around 5–6% annually. Nevertheless, the early childhood age group remains the focus of this study because it falls within the “golden age”—a critical period for habit formation and child development. At this stage, children are more receptive to learning, including habits related to maintaining dental health. Therefore, early dental health education is considered important as a preventive measure to reduce the risk of dental health problems in children.

4. Results And Discussion

Design Methodology

This study employs the design thinking method, which focuses on creative problem-solving and is centered on user needs. This method is used to understand user needs, formulate problems, develop ideas, and test the designed solutions. The use of this method is based on the limited availability of dental health educational materials capable of stimulating children's fine motor skills; therefore, an interactive learning medium suitable for the characteristics of early childhood was developed.

The Stages of Design Thinking

The design thinking method consists of five stages: Empathize, Define, Ideate, Prototype, and Test.

Empathize

The Empathize phase involved observing and analyzing data from patients at the Fransiskus Leo Dental Clinic to understand the oral health education needs of children aged 2–6 years. In addition, the study examined children’s developmental characteristics, particularly their learning styles, fine motor skills, and tendency to learn through play and visual media.

Define

The Define phase focuses on formulating the problem based on the results of data and literature analysis. The main issue identified is the limited availability of interactive and engaging dental health educational materials for young children. Therefore, an interactive activity book was designed to actively engage children while stimulating their fine motor skills.

Ideate

The Ideate phase is the process of developing educational media concepts tailored to the characteristics of young children, including the selection of illustrations, colors, layout, and interactive activities. The visual media uses simple cartoon illustrations with bright colors to make it appealing and easy for children aged 2–6 to understand. The activities developed include matching pictures, choosing healthy foods, and recognizing good oral hygiene habits.

Prototype

The prototype phase involves creating an initial draft of an interactive activity book containing illustrations, simple games, and interactive elements related to dental health education. The prototype serves as an initial model to visualize the application of design concepts—both visually and functionally—prior to evaluation.

Testing

The testing phase is conducted to evaluate the visual aspects, ease of use, and suitability of the media for young children. The test results are used to refine the design so that the media can function optimally as an engaging and interactive tool for dental health education.

Book Design

The book design phase builds on the design thinking process by developing concepts into more concrete visual forms. The process begins with the creation of a mood board to establish the visual direction, including color, illustrations, typography, and the overall tone of the material. Next, the design and content concepts are tailored to the characteristics of children aged 2–6 to create an interactive and engaging learning tool that supports learning through play.

Development of Initial Visual Concepts

The development of initial visual concepts is a stage undertaken to determine the design direction for an interactive activity book. This stage involves gathering visual references such as illustrations, typography, colors, and visual styles to serve as a guide for the design process. The visual concept is designed to create a simple, appealing, and easy-to-understand look for young children. The illustrations are cartoon-style, featuring simple and expressive shapes to help children easily recognize objects and understand the messages conveyed. The typography was chosen to suit the personalities of children aged 2–6: simple, easy to read, and approachable. The primary font used is Buddy Play, with its rounded, expressive shapes that convey a cheerful vibe. The secondary font is Poppins SemiBold, used for informational text due to its clean, easy-to-read appearance. Examples of Buddy Play characters:

Aa Bb Cc Dd Ee Ff Gg Hh Ii Jj Kk Ll Mm

Nn Oo Pp Qq Rr Ss Tt Uu Vv Ww Xx Yy Zz

0 1 2 3 4 5 6 7 8 9 & . , ; ? ! () @ % + = *

Examples of Poppins SemiBold characters:

Aa Bb Cc Dd Ee Ff Gg Hh Ii Jj Kk Ll Mm

Nn Oo Pp Qq Rr Ss Tt Uu Vv Ww Xx Yy Zz

0 1 2 3 4 5 6 7 8 9 . , ; ? ! () @ % + = *

By combining these two typefaces, the visual presentation of the interactive activity book becomes more engaging, communicative, and easy for children to read. Additionally, bright and clean colors are used to create a cheerful atmosphere in line with the dental health theme. The layout is designed with a sense of balance, specifically asymmetrical balance, ensuring the composition remains dynamic yet not lopsided. Furthermore, Gestalt principles such as proximity and similarity are applied to make the visual elements more structured and easier for children to understand.

Character and Object Sketch Development

The character and object sketch development phase serves as an initial visualization process prior to finalizing the design. Characters and objects are created as simple line sketches without coloring to explore shapes, proportions, and visual expressions that align with the design concept. This stage aims to evaluate and adjust the design before entering the finalization process, ensuring the resulting visuals are more refined, consistent, and in harmony with the concept of the interactive activity book.

Book Page Layout Design

The layout design phase is carried out to determine the placement of visual elements such as characters, illustrations, text, and activity areas on each page of the book. The layout created at this stage is preliminary, intended to visualize the page structure and provide an estimate of the final result during the printing process. This interactive activity book employs an asymmetrical layout with varied and flexible visual elements, resulting in a dynamic and harmonious design. This approach was chosen to create an engaging and non-monotonous design that enhances children's interest in interacting with the book. In addition, the layout was designed with the child's ease of following the sequence of activities in mind, so that every visual element and interactive area can be used optimally in line with the dental health learning objectives.

Final Development of Characters, Objects, and Environments

This stage involves refining the visuals from sketches into final designs ready for use in an interactive activity book. Refinements are made to proportions, shapes, and coloring to ensure the visuals are more communicative, consistent, and easy for children aged 2–6 to understand. The main characters are designed to be simple and expressive, featuring round faces, large eyes, and a variety of expressions to support visual communication. The use of bright colors aims to attract attention and increase children's engagement in the learning process. Supporting materials focus on dental health items such as toothbrushes, toothpaste, and simplified illustrations of tooth anatomy for easy recognition. The steps for brushing teeth are presented in sequence to help children understand the process systematically. The environment is designed using spaces familiar to children, such as bedrooms, bathrooms, and playrooms, making it more relatable to their daily lives. Visual details are kept minimal to ensure the primary focus remains on the characters and learning activities. All visual elements are brought together through the use of cartoon illustrations, bright colors, and consistent, simple shapes to create an appealing look that effectively conveys an educational message.

Interaction Design for Interactive Activity Books

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This phase focuses on developing interactive elements to enhance children’s engagement in the learning process while stimulating the fine motor skills of children aged 2–6 years. The interactive elements include fold-out pages for exploring information, a sliding feature to demonstrate the step-by-step motion of brushing teeth, a picture-matching activity using magnets to practice hand-eye coordination, and an activity involving selecting and grouping pictures—such as distinguishing between foods that are good and bad for dental health.

Interactive Activity Book Mechanics

The book’s mechanics are designed to encourage direct interaction between children and the media, ensuring that the learning process is not only visual but also involves physical activity. Each mechanic is implemented in accordance with the learning objectives on a specific page. One of the mechanisms used is a flap mechanism to reveal hidden information, such as the differences between good and bad habits in maintaining dental health. Children can lift the flaps to find the answers, thereby increasing their curiosity and engagement in the learning process.

Tabel 2. Details of Flap Mechanisms

Page	Mechanical Type	Number of Folds/Elements	Mechanical Explanation
Page 3	Open and Close (Flap)	1 fold	This activity involves opening a cabinet to retrieve items such as a toothbrush and toothpaste, and then placing them in a glass. The goal is to help children develop hand-eye coordination while introducing them to dental hygiene supplies.
Page 5	Open and Close (Flap)	6 fold	There are six flaps that illustrate the steps of brushing your teeth. Each flap is opened in sequence to help children understand the steps for brushing their teeth correctly in a systematic and easy-to-follow way.
Page 8	Open and Close (Flap)	1 fold	This activity involves a small book that opens up and contains simple explanations of tooth anatomy, along with illustrations of different types of teeth, such as incisors, canines, and molars. It helps children visually recognize the parts of a tooth, making the concept easier to understand.
Page 9	Open and Close (Flap)	3 fold	The flaps open in different directions to reveal information about the importance of brushing your teeth. This mechanism is designed to provide a more interactive, exploratory, and engaging learning experience for children.

Sliding Mechanism

The sliding mechanism allows children to move the elements left and right to display illustrations of toothbrushing motions. This interactive feature helps children gradually understand toothbrushing techniques in a more visual, interactive, and easy-to-understand way.

Table 3. Details of Sliding Mechanisms

Page	Mechanical Type	Number of Folds/Elements	Mechanical Explanation
Page 6	Slide (Sliding)	1 sliding element (toothbrush)	The sliding mechanism is designed to move left and right to simulate the motion of brushing teeth. Children can slide the illustration so that the character appears to be brushing their teeth. This interactive feature helps children understand the correct direction and technique for brushing their teeth in a visual, interactive, and fun way.

Pull Tab Mechanism

The pull tab mechanism uses a downward-pulling system that causes visual elements to move upward, making the object appear to emerge or rise. This interaction provides an engaging learning experience and helps children understand processes or gradual changes through simple, easy-to-do activities.

Tabel 4. Details of Pull-Tab Mechanisms

Page	Mechanical Type	Number of Folds/Elements	Mechanical Explanation
Page 15	Pull (Pull Tab)	5 Key Elements (5 Steps to Keep Your Teeth Healthy) (5 Steps to Keep Your Teeth Healthy)	A pull-down mechanism that causes visual elements to move upward, making objects appear to emerge or rise. This interaction helps children understand the process step by step in a simple and engaging way.

Magnetic Mechanics (Magnetic Interaction)

Magnetic mechanics are used in activities that involve matching objects, such as distinguishing between healthy and damaged teeth and placing objects according to their role in dental care. The use of magnets makes it easier for children to move and attach objects while also developing fine motor skills through simple and engaging interactions.

Tabel 5. Details of Magnetic Interaction Mechanisms

Page	Mechanical Type	Number of Folds/Elements	Mechanical Explanation
Page 11-12	Magnet (Magnetic Interaction)	4 magnetic element	Magnetic pieces are used on clothing items (shirts, pants, and shoes) to complete the illustration of a dentist. Children can attach the pieces to the corresponding spots on page 12 of the picture to visually understand what a dentist looks like.
Page 13-14	Magnet (Magnetic Interaction)	12 magnetic element	The magnetic mechanism is used to replace damaged teeth with healthy ones. Children can move the unhealthy teeth to page 14 to collect them, helping them understand the basics of dental care and oral health in a simple way.

Match and Select Activity Mechanics

In this activity, children are asked to select or group pictures of foods that are good and bad for dental health. The activity is designed using simple, easy-to-understand visuals to help children recognize habits that support dental health.

Tabel 6. Details of Matching and Selection Activities

Page	Mechanical Type	Number of Folds/Elements	Mechanical Explanation
Page 16	Picture-matching activity	6 images of objects	Children are asked to match the pictures to the categories of healthy teeth and damaged teeth by dragging the pictures vertically along the provided lines. This activity helps children understand the differences in the condition of teeth through simple, easy-to-understand visual interactions.

All of the interactive activities in this book are designed to spark children’s interest in learning while helping to develop their fine motor skills and understanding of the importance of maintaining good dental health from an early age.

Development of an Interactive Activity Book Prototype

The prototyping phase serves as an initial test before final production to ensure that all the book's mechanical features function properly. The prototype is used to test folding, sliding, and pulling mechanisms, as well as object-matching activities. During this phase, adjustments are made to the size, position, and strength of the materials to ensure the book remains safe and easy for children to use.

Production of the Interactive Activity Book

After the prototype phase was completed, the process moved on to final production using durable and comfortable materials. The book cover uses 190-gram TIK paper laminated with cardboard, while the interior pages use 260-gram TIK paper for added sturdiness. The book consists of 13 pages containing various dental health learning activities, such as identifying dental hygiene tools, the steps for brushing teeth, parts of the tooth, and picture-matching activities. After printing is complete, mechanical assembly—such as folding, sliding, pulling, and magnet attachment—is performed so that all interactive elements can be used optimally. The final result is a visually appealing interactive activity book that provides a fun learning experience for children.

Branding Design for an Interactive Activity Book

The branding design was created to establish a consistent visual identity across the book, packaging, and supporting materials. The branding is designed to increase children's interest in dental health educational materials.

Packaging Design

The book packaging is designed as a hard box with a matte laminate finish to ensure it is sturdy, neat, and durable. The packaging size is tailored to accommodate all product components, including the interactive activity book, 3D tooth activity, children's toothbrush, and tooth-shaped crochet keychain. The packaging design is harmonized with the book's illustrations to create a consistent and appealing visual identity.

Design of Supporting Materials

The supporting materials designed include child-friendly toothbrushes, 3D dental activities to develop fine motor skills through cutting and pasting, and knitted tooth models as visual aids to demonstrate healthy and damaged teeth.

Book Promotion Plan

Book promotion is carried out through materials displayed at the Fransiskus Leo Dental Clinic to raise awareness of the book as an educational resource on dental health for young children.

Implementation Documentation

Based on the implementation results, 3-year-olds showed a high level of interest in the book due to its bright colors and engaging illustrations, although they still required parental guidance when using the material. Meanwhile, 6-year-olds were able to understand the instructions and complete the activities more independently. These results indicate that interactive activity books are effective as a dental health education tool that aligns with children's cognitive development and problem-solving skills.

5. Conclusion

Based on the results of the design of an interactive activity book on dental health for children aged 2–6 years, it can be concluded that visual elements were effectively implemented through the use of simple, expressive cartoon-style illustrations, the selection of bright colors that capture children's attention, and the use of easy-to-read typography. The layout, which applies design principles, also helps convey information more clearly and makes it easier for children to understand, so that the visuals serve not only an aesthetic purpose but also as an educational communication medium. The design process for this book

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utilized the design thinking method, which includes the stages of empathize, define, ideate, prototype, and test. Each stage was carried out systematically, focusing on the needs and characteristics of young children as the primary users. This process resulted in an interactive educational media concept, realized in the form of a book featuring various interactive elements such as flaps, sliders, pull-tabs, and magnets. The testing process also helped refine the design so that the resulting educational media could be used effectively and align with the learning objectives. Based on the results of the implementation, this interactive activity book can be considered effective as a dental health education tool. This is evident from the children's responses, which showed a high level of interest in the visuals and activities presented, as well as their ability to interact with the material. Three-year-olds still require more intensive guidance, while six-year-olds also need guidance but are already more independent in understanding and completing the activities. This indicates that the medium is capable of enhancing children's engagement, understanding, as well as their motor and cognitive development. Educational materials on dental health for young children still need to be developed so that learning can take place in a more engaging and interactive way. Therefore, future research is expected to develop a wider variety of activities, interactive mechanisms, and visual designs so that interactive activity books become more innovative and effective as learning tools. In addition, it is hoped that educational materials such as this interactive activity book can be utilized more widely by the public, particularly by parents, educators, and those involved in children's dental health. In this way, this book can serve as a tool to help raise awareness of the importance of maintaining good oral health from an early age.

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