

ARTICLE

Improving Dental Health Knowledge Through Education Using Pop-Up Books for Street Children at Sanggar Alang-Alang Surabaya

Difa Santi Prasetyo, Sunomo Hadi*, Agus Marjianto

Program Studi Terapis Gigi, Jurusan Kesehatan Gigi, Poltekes Kemenkes Surabaya, Indonesia

*Corresponding author: sunomohadi@gmail.com

Abstract

Oral health is an important aspect of maintaining overall health. Street children are a vulnerable group with limited access to health information and services, especially oral health. The problem identified by researchers is the inadequate knowledge of oral health among street children. The purpose of this study was to understand the difference in dental health knowledge before and after providing education using pop-up books to street children. The research method used was a pre-experiment with a one-group pretest-posttest approach. The sample consisted of 36 street children at Sanggar Alang-Alang. Data were collected using questionnaires administered before and after the education session. Data analysis was performed using the Wilcoxon test. The results of the study showed a significant difference in the average knowledge score before the intervention, which was 58.47 ± 9.770 , and increased to 84.44 ± 6.947 after the pop-up book intervention (0=0.000). Conclusion: there was a difference in dental health knowledge before and after the intervention using pop-up books.

Keywords: Knowledge, Dental Health, Pop-Up Book, Street Children, Education

1. Introduction

Oral health is an important component of overall health, as the two influence each other. Knowledge about oral health is one of the main strategies in efforts to improve health status. Street children are a vulnerable group that is at higher risk for this health problem. Increased urbanisation and the spread of slums, especially in developing countries, have led to more children taking to the streets to earn a living for themselves and their families(Syariatilah, Mulyanti, Insanuddin, & Supriyanto, 2021). Row household income has been consistently identified in previous studies as one of the main factors contributing to the incidence of caries in children (Cousins, David, Bradshaw, & Sherriff, 2025).

The 2023 Indonesian Health Survey (SKI) data shows that 75.7% of children aged 10–14 brush their teeth every day, but only 5.3% do so at the right time. In the 5–9 age group, 73.6% brush their teeth every day, but only 4.6% do so correctly, while 84.8% experience dental caries (Munira et al., 2023). Inequality in access to health and education services is the main cause of these high rates, as also pointed out by Jiang et al. (2025), who highlight the role of educational and economic status as key determinants of children's dental health.

Proper handling of dental and oral health problems in street children requires a promotional approach

through structured education. This education aims to increase knowledge and encourage changes in health behaviour, such as proper tooth brushing habits. These efforts can be carried out through the provision of information, persuasion, appeals, and awareness-raising using educational media such as interactive and engaging pop-up books (Haryani et al., 2023). This media is a type of educational book equipped with three-dimensional (3D) elements that can move when the pages are opened, thereby providing attractive and interactive visualisations to improve children's understanding of the material being presented (Setiyanigrum, 2020). Therefore, in order for the outreach to be active, creative, interesting and meaningful, outreach workers must create media that can be used to explain the outreach material better and more creatively (Izzah & Setiawan, 2023).

A preliminary survey was conducted on 21 July 2024 on 14 street children. Poor oral health was found among street children. The average DMF-T index for street children was 5.5, which according to the WHO is classified as high. Research on the effectiveness of pop-up books in dental health education for street children has not been extensively studied scientifically. Therefore, this study is urgent because it can make an important contribution not only to efforts to improve health literacy among vulnerable groups but also to the development of more inclusive dental health education strategies. In the context of public health science, this study reinforces a community-based educational approach that is adaptive to the social and psychological background of the target population. Meanwhile, in the field of dental health education, this research opens up opportunities for the development of more creative, contextual, and effective teaching media to be applied in various non-formal settings.

Previous studies have focused on the description of oral health conditions and the level of understanding among street children, but few have examined the effectiveness of direct educational interventions. Therefore, this study aims to provide oral health education to street children using popup books and to analyse the difference in their level of knowledge before and after the intervention.

2. Materials and Methods

2.1 Research Design

This study used a pre-experimental design with a *one group pretest–posttest design*. This design was used to assess the effectiveness of dental health education on the knowledge level of street children by providing intervention to one group without a control group for comparison. In this design, measurements were taken twice, before the intervention (pretest) and after the intervention (posttest). This approach allowed researchers to directly assess changes in respondents' knowledge levels as a result of the intervention. This design is considered appropriate because field conditions do not allow for the formation of a homogeneous control group, given that the population of street children has varying social characteristics and educational backgrounds. Thus, each respondent serves as a control for themselves, so that changes in knowledge scores can be attributed to the effect of education using *pop-up books*.

2.2 Population and Sample

The study population consisted of all street children actively participating in activities at Sanggar Alang-Alang, numbering 48 children. The sample size was determined using the Slovin formula with a 5% margin of error, resulting in 36 respondents who met the study criteria. Respondents were selected using purposive sampling, based on specific considerations relevant to the study objectives.

The inclusion criteria for this study were street children aged between 8 and 17 years old, actively participating in coaching activities at the studio, able to read and understand simple instructions, and willing to participate in the entire series of research activities. Children who were absent during the counselling session or did not complete the questionnaire were excluded from the analysis. The characteristics of the respondents obtained consisted of 63.9% female and 36.1% male, with the largest age range in the 10–12 year old group.

2.3 Research Variables

The main variable in this study was oral health knowledge, which was measured before and after the educational intervention. Knowledge was defined as the result of a cognitive process that demonstrated the respondents' understanding of basic oral health concepts, toothbrushing habits, factors causing tooth decay, and preventive measures. Changes in the mean pretest and posttest scores were used as indicators of knowledge improvement after education was provided using pop-up books.

2.4 Research Instruments

The instrument used was a dental and oral health knowledge questionnaire developed based on the Indonesian Ministry of Health's guidelines for children's dental health education. This questionnaire consisted of 20 closed-ended questions with true or false answer options. Each correct answer was given a score of 1 and each incorrect answer was given a score of 0, with a maximum total score of 20. The instrument underwent validity and reliability testing before use. The validity test was conducted using an *item-total* correlation analysis, with the results showing that most items had a correlation value above 0.30. The reliability test using Cronbach's Alpha method showed a value of 0.645, indicating a sufficient and acceptable level of internal consistency. Based on these results, the instrument was deemed suitable for use as a tool to measure street children's knowledge of dental health.

2.5 Research Procedure

The research consisted of three main stages: preparation, intervention, and data collection. During the preparation stage, researchers coordinated with Sanggar Alang-Alang administrators to determine the activity schedule and prepare educational tools in the form of pop-up books. This media contains three-dimensional illustrations depicting dental anatomy, the correct way to brush teeth, and the impact of poor oral hygiene on health. The media is designed to be interactive and colourful in order to attract children's attention and facilitate understanding.

The implementation stage began with administering a pretest to all respondents to measure their initial level of knowledge. This was followed by dental and oral health education using a pop-up book for approximately 45 minutes. The education process was conducted in a participatory manner, in which children were encouraged to interact, ask questions, and imitate the correct way to brush their teeth. After the activity was completed, respondents were given a post-test using the same questionnaire to measure the increase in knowledge after the intervention. The final stage involved collecting, coding, and processing data for statistical analysis. Each questionnaire was checked for completeness before analysis.

2.6 Data Analysis

The data were analysed using a quantitative approach. Descriptive analysis was used to describe the characteristics of respondents based on age, gender, and distribution of knowledge levels before and after the intervention. The results were presented in the form of frequency tables and percentages. To determine whether there was a difference in knowledge levels before and after the intervention, the Wilcoxon Signed Ranks Test was used because the data was ordinal and not normally distributed. A p-value of p-value < 0.05 was used as the significance threshold. If the p-value was less than 0.05, it was concluded that there was a significant difference between knowledge levels before and after education using pop-up books. The results of this test were used to prove the hypothesis that pop-up books were effective in increasing street children's knowledge about dental health.

3. Results and Discussion

Table 1. Respondent Characteristics

Characteristics	Category	n	%
Age (years)	8–9	5	13.9

	10–12	12	33.3
	13–15	9	25.0
	16–17	10	27.8
Gender	Male	13	36.1
	Woman	23	63.9
Total		36	100

As shown in Table 1, most respondents were in the 10–12 age group (33.3%), followed by those aged 16–17 (27.8%). This indicates that the majority of participants were in the primary school to early adolescence age range, which is an important period in the formation of personal hygiene behaviours, including toothbrushing habits. Based on gender, female respondents (63.9%) outnumbered male respondents (36.1%). This proportion illustrates that girls are more involved in Sanggar Alang-Alang activities and are the target of educational interventions.

Table 2. Knowledge Levels Before and After Intervention

Knowledge Category	Before counselling n (%)	After counselling n (%)
Baik	0 (0.0)	32 (88.9)
Cukup	20 (55.6)	4 (11.1)
Less	16 (44.4)	0 (0.0)
Total	36 (100)	36 (100)

The results presented in Table 2 show that before the intervention, none of the respondents had knowledge in the *good* category; most (55.6%) were in the *fair* category, while the other 44.4% were in the *poor* category. After conducting education using pop-up books, there was a significant increase in the good category to 88.9%, while the poor category was no longer found. This change illustrates that health education interventions through interactive visual media successfully improved street children's understanding of basic dental and oral hygiene concepts. This upward trend in knowledge also indicates that visual and participatory learning approaches are more effective than conventional lecture methods in the context of street children groups.

Table 3. Statistical Analysis of Knowledge Differences

Variable	n	Mean ± SD	p-value
Before the counselling session	36	58.47 ± 9.77	
After the briefing	36	84.44 ± 6.95	0.000

Based on the statistical test results presented in Table 3, there was an increase in the average knowledge score from 58.47 ± 9.77 before the education to 84.44 ± 6.95 after the education. The p-value of 0.000 (p 0.05) indicates that the difference is statistically significant. This means that there is a noticeable effect of using pop-up books on improving the dental health knowledge of street children. These results confirm that the use of interactive educational media can facilitate a more effective learning process because it involves visual, kinesthetic, and cognitive aspects simultaneously. This is in line with the multimodal learning theory, which states that information conveyed through more than one sensory channel tends to be easier for learners to understand and remember.

Based on the results of the study, it was found that before the intervention using pop-up books, the street children's knowledge level was adequate, as indicated by their average knowledge scores. The level of knowledge of street children was mostly in the adequate category, influenced by many factors, one of which was education. If not all respondents received formal education, then they would not acquire comprehensive knowledge related to health, as well as the lack of attention and education from their parents, especially regarding dental and oral health. Health education is an educational

activity carried out through the dissemination of messages, namely by fostering self-confidence in order to know, understand, comprehend, want and implement recommendations related to dental and oral health (Mardiati, Nurilawaty, Noviani, & Wiradona, 2024).

The public should utilise various media to receive information related to dental health, where all knowledge is received or captured by the five senses. The more senses that are used, the clearer the understanding and knowledge that will be obtained. In other words, this medium aims to stimulate as many senses as possible on an object, thereby facilitating individual perception (Nubatonis & Ayatulah, 2019). The success of children's dental health education in schools is closely related to the importance of the role of education and media because it will support the learning process and make it easier for students to understand the material. Through the media, the information provided becomes more interesting and easier to understand (Husna & Prasko, 2019).

The success of health promotion is greatly influenced by the effective use of media in conveying messages, including educational media and targeted visual communication. In this way, people can improve their control and behaviour in order to develop their own health. Health promotion media is a way of presenting information through print, electronic or outdoor media to increase the knowledge of the target audience and hopefully bring about better behavioural changes in the field of health (Sutrisno & Sinanto, 2022). This statement is in line with the theory put forward by Notoatmodjo (2014), who states that Knowledge, attitudes, and actions are stages in the process of behavioural change. Before a person, including street children, engages in a health behaviour, they need to first understand the benefits of that behaviour. Health education plays a role in conveying information that encourages individuals to recognise, understand, and respond to the stimuli provided. Thus, indicators of attitudes towards health should be in line with the information received in order to form positive health behaviours.

The most influential media are tools that optimally improve understanding of dental health. Among the various types of print media used as educational tools, pop-up books are among the most widely used in health education. Pop-up books are an example of media that can bring out 3D visual components because the lessons are displayed. This medium can increase learning efficiency while making abstract learning more informative (Surya, Fitriana, & Fitriyani, 2021). This is relevant to the study by Izzah & Setiawan (2023), which states that pop-up books are 3D media with images that pop up when the pages are opened. pop-up books facilitate the presentation of material in a more interesting way in terms of images that can appear and are three-dimensional.

Based on the results of the study, it was found that the knowledge of street children after receiving dental health education using pop-up books showed good results. This was due to the pop-up book media that was given to street children and the attitude of street children who accepted and responded well to the information provided by the educators. This study is relevant to the findings of Abral et al. (2020), which state that the success of health education as a strategy to improve health is closely related to the media used by the presenter to realise the active role of the community. According to research by Mona & Lestari (2024), there was an increase in dental and oral health knowledge after education was provided using pop-up books. This is because the media can generate interest and facilitate the dissemination of health information, as well as prevent differences in perspective so that information can be clearly understood. The media can also facilitate communication. Educational media can also be used as a supporting instrument that can stimulate the thoughts, feelings, attention, and interest of the recipients of the material. This finding is relevant to a study conducted by Widjanarko, Hadi, & Marjianto (2022), which states that there is an impact of health education using pop-up books because the use of attractive aids can increase respondents' understanding, which ultimately encourages an improvement in proper tooth brushing skills.

Media pop-up books have advantages as educational tools for children, mainly because of their visual and attractive appearance. Made from thick and durable materials, this medium is able to increase children's attention and participation during learning, both individually and in groups. However, this medium also has limitations, such as a production process that requires time and high precision, as well as relatively high costs due to the use of special materials. Therefore, its effectiveness needs to be considered in terms of resource availability and sustainability in broader educational

implementation (Izzah & Derivative amp; Setiawan, 2023). These findings are in line with studies by Prasetyowati, Mukhlishoh, & Ulfah (2023), which shows that pop-up books can improve respondents' toothbrushing skills because the three-dimensional, movable display of pop-up books can present the real world in a concrete way. Similarly, Lestari, Larasati, & Dep-up books are a type of 3D media that can bring visual components to life. Pop-up books can strengthen students' understanding of material that is difficult to understand directly. This study shows an increase in awareness of dental and oral hygiene by utilising pop-up tools.

Supported also by a study from Yuniarly, Haryani, & Eldarita (2023) showing a significant increase in knowledge after health promotion using educational media. These findings confirm the role of media in strengthening individuals' cognitive aspects related to dental health. However, increased knowledge is not always followed by behavioural changes, so the evaluation of interventions also needs to include their impact on attitudes and actions in the long term. This is also reinforced by a study by Sulistyorini, Marludia and Nurrochman (2023). The results of the study show that before the intervention, children's understanding of dental health was still low. After being given pop-up books, there was a significant increase in knowledge, supporting the effectiveness of this media in children's dental health education. The results of a study by Ayomi, Hadi, & Marjianto (2024) also support these findings, showing an increase in students' understanding of dental and oral hygiene after using Castle Pop-up. In addition to increasing appeal, visual media also helps children with low literacy skills to understand information more intuitively.

This occurs because changes in knowledge result from the process of acquiring information obtained through an individual's interaction with stimuli or observed objects, primarily through the senses of sight and hearing. This process contributes to increased understanding and changes in a person's cognitive aspects. These cognitive aspects play an important role in shaping and influencing changes in individual behaviour (Adventus, Jaya, & Mahendra, 2019). From the findings of studies that have been conducted, researchers argue that the use of pop-up books during dental and oral health education has been proven to increase the knowledge of street children. This is evidenced by the significant difference between the level of knowledge before and after the intervention. Before the education was provided, the majority of respondents' knowledge was in the adequate category, but after the education was implemented, there was a significant increase to the good category.

4. Conclusion

This study shows a significant increase in dental and oral health knowledge among street children at Sanggar Alang-Alang Surabaya after being given an intervention using pop-up books. Previously, the children's knowledge was in the adequate category, but it improved to the good category after the intervention. These findings prove that *pop-up books* are effective as educational tools that are interesting and easy to understand, especially for vulnerable groups of children.

In practical terms, this medium can be used in child health education programmes, while theoretically supporting the effectiveness of interactive visual approaches in learning. Further research is recommended to cover more locations and develop locally-based media to increase the long-term impact on children's health knowledge and behaviour.

Ethics approval and consent to participate

This study has obtained ethical approval from the Health Research Ethics Committee of the Surabaya Ministry of Health Polytechnic. Prior to data collection, all respondents were given an explanation of the purpose, benefits, and procedures of the study in easy-to-understand language. Participation consent was obtained through an informed consent form signed by the respondent or their guardian. The confidentiality of the respondents' identities was maintained, and all data was used solely for research purposes. The counselling activities were conducted with due regard for the children's comfort and their right to refuse or withdraw from participation at any time without consequences.

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