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Interactive pop-up book education and preoperative anxiety among school-aged children undergoing general anaesthesia

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Abstract

Background: Surgical procedures involving general anaesthesia are often unfamiliar experiences for school-aged children (6–12 years), frequently triggering preoperative anxiety. Unresolved anxiety may affect physiological stability and hinder the recovery process. Therefore, innovative educational media that are appropriate to children's developmental stages, such as interactive popup books, are needed to provide visual and engaging explanations of medical procedures and help reduce psychological distress.

Purpose: To determine the effect of educational intervention using an interactive pop-up book on preoperative anxiety levels among paediatric patients undergoing general anaesthesia.

Method: A pre-experimental design with a one-group pretest–posttest approach. The study sample consisted of 63 respondents selected using a purposive sampling technique. Anxiety levels were measured using the Chinese Version State Anxiety Scale for Children (CSAS-C). Data were analysed using the Wilcoxon Signed Rank Test.

Result: Prior to the intervention, the majority of respondents (58.7%) experienced severe anxiety. Following educational intervention through the interactive pop-up book, a significant reduction in anxiety levels was observed, with most respondents classified as having moderate anxiety (57.1%) and mild anxiety (31.7%). Statistical analysis showed a p-value of 0.000 ($p < 0.05$), indicating a significant effect of the intervention.

Conclusion: Preoperative anxiety scores decreased significantly following interactive pop-up book education among school-aged children undergoing general anaesthesia. Controlled studies are needed to confirm the effectiveness of the intervention.

Keywords: General Anaesthesia; Pop-Up Book; Preoperative Anxiety; School-Aged Children.

INTRODUCTION

Preoperative anxiety is one of the most common psychological problems experienced by paediatric patients before undergoing surgery (Liang, Huang, Hu, Jiang, Liu, Yue, & Li, 2021). Anxiety can arise due to fear of medical procedures, unfamiliar hospital environments, pain, the use of medical equipment, and separation from parents during the treatment process (Supangat, Sakinah, Nugraha, Baswedan, & Haritsah, 2024). This condition can trigger physiological responses such as increased blood pressure, pulse rate, and respiratory rate, and affect a child's readiness for surgery. Unresolved preoperative anxiety can also increase the need for postoperative

analgesics, trigger agitation and delirium, and slow the postoperative recovery process (Mustafa, Shafique, Zaidi, Qamber, Rangwala, Ahmed, & Haseeb, 2024). One procedure that often causes anxiety in paediatric patients is surgery under general anaesthesia. General anaesthesia causes a temporary loss of consciousness, pain sensation, and protective reflexes, making the patient unaware of the surgical procedure (Millizia, Maghfirah, & Rizaldy, 2023). School-aged children are a vulnerable group to anxiety because they still need concrete explanations to understand the medical procedures they will undergo. A lack of understanding of anaesthesia and

surgical procedures can increase negative perceptions of the procedure, thus exacerbating preoperative anxiety (Riswandi, Santoso, & Andriyanto, 2025).

Various efforts have been made to reduce preoperative anxiety in children, using both pharmacological and nonpharmacological approaches. Nonpharmacological interventions are increasingly used because they are relatively safe, easy to implement, and have no side effects. One recommended approach is preoperative health education. Education provided according to the child's developmental stage can help improve understanding of the procedure, thereby reducing uncertainty and anxiety (Wahyuningsih & Sari, 2025). One educational medium with potential for use with paediatric patients is the pop-up book. This medium presents information in an engaging and interactive three-dimensional visual format, thereby increasing children's attention and understanding of the information provided (Fajriah, Sadiah, & Setiabudi, 2022). Interactive visual media can increase children's engagement in the learning process (Christiani, Pujiastuti, Astuti, & Wiyono, 2026). Pop-up books have been proven effective in improving the knowledge and skills of school-aged children because they present information in a concrete and easy-to-understand manner (Mordayanti, Winarni, Mujito, & Suryani, 2023). Providing picture books about surgical procedures before the procedure can reduce preoperative anxiety and increase children's cooperation during the anaesthesia induction process Yang, Zhang, Sun, Peng, Zheng, & Zheng, 2022).

Previous research shows that educational media is effective in reducing anxiety in children. Educational play tools were effective in reducing preoperative anxiety in school-aged children (Weningtyastuti, 2020). Educational play therapy using flashcards effectively reduced pre-anaesthetic anxiety in school-aged children. However, scientific evidence regarding the effectiveness of interactive pop-up books as a pre-operative educational tool for paediatric patients undergoing general anaesthesia is still limited. Therefore, further research is needed to strengthen the evidence regarding the use of interactive pop-up books in reducing pre-operative anxiety in paediatric patients.

Based on a preliminary study at Muhammadiyah Gamping Hospital on October 29, 2025, 137

paediatric patients underwent general anaesthesia during the period of August–October 2025. The high number of paediatric patients undergoing general anaesthesia demonstrates the importance of interventions that can help prepare children's psychological condition before surgery. This study proposes the use of an interactive pop-up book specifically designed to provide education about general anaesthesia and surgical procedures to paediatric patients. This media is expected to help children understand the procedures to be undergone, reduce uncertainty, and reduce anxiety levels before surgery. The results of this study are expected to strengthen scientific evidence regarding the use of interactive visual educational media as a non-pharmacological intervention in reducing preoperative anxiety in children and serve as a reference for nurse anaesthetists and health workers in implementing preoperative education.

RESEARCH METHOD

A quantitative method with a pre-experimental design using a one-group pretest–posttest design. The study intervention was interactive pop-up book education on preoperative anxiety levels of paediatric patients under general anaesthesia. The population in this study consisted of all school-age paediatric patients (6–12 years old) who would undergo surgery under general anaesthesia. The research sample consisted of 63 patients, with the sampling technique being purposive sampling. The data collection instrument used was the Chinese Version State Anxiety Scale for Children (CSAS-C) observation sheet. The questionnaire has 20 statement items consisting of 10 statements related to subjective anxiety, and 10 statements related to physiological anxiety using a Likert scale with answer choices: 1 = no symptoms, 2 = mild symptoms, and 3 = severe symptoms. The Chinese Version State Anxiety Scale for Children (CSAS-C) instrument developed by Li and Lopez (2004) and modified by Apriliawati (2011) has been proven valid with a calculated r value of > 0.632 and reliable with a Cronbach's Alpha value of 0.886 . The interactive pop-up book media used as an intervention also was reviewed by experts before being used in the study to ensure the suitability of the content, illustrations, and language before being used as an intervention medium. The research procedure began with measuring the level of preoperative

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anxiety (pretest) using the CSAS-C questionnaire. Respondents were then given 10 minutes of education using an interactive pop-up book. After the intervention was completed, the researchers gave the patients time to understand the content of the education. On the following day, prior to the surgical procedure, a posttest was conducted using the same questionnaire to assess participants' knowledge and anxiety levels. Univariate and bivariate analyses were

subsequently performed. Univariate analysis is presented in the form of frequency distribution and percentage to describe the characteristics of respondents and the level of preoperative anxiety. Bivariate analysis used the Wilcoxon Signed Rank Test with a significance level of $p < 0.05$. This study has obtained ethical approval from the Ethics Committee of Muhammadiyah Gamping Hospital Number 038/KEP-PKU/II/2026.

RESEARCH RESULTS

Tabel 1. Frequency of Respondent (N=63)

Variable	Results	P-Value
Age (n/%) (Mean$\pm$SD) (Range) (Year)	(9.3 $\pm$ 1.7) (6-12)	
6	5/7.9	
7	5/7.9	
8	11/17.5	
9	13/20.6	
10	13/20.6	
11	8/12.7	
12	8/12.7	
Gender (n/%)		
Male	25/39.7	
Female	38/60.3	
ASA Physical Status (n/%)		
ASA I	39/61.9	
ASA II	24/38.1	
Pre-test Anxiety Level (n/%)		
Mild	0/0.0	<0.001
Moderately	23/36.5	
Severe	37/58.7	
Panic	3/4.8	
Post-test t Anxiety Level (n/%)		
Mild	20/31.7	
Moderately	36/57.1	
Severe	7/11.1	
Panic	0/0.0	

Based on the respondent frequency table, the respondents had a mean age of 9.3 ± 1.7 years, with an age range of 6–12 years. Most respondents were aged 9 and 10 years (13; 20.6% each), followed by 8 years (11; 17.5%), 11 and 12 years (8; 12.7% each), and 6 and 7 years (5; 7.9% each). Female

respondents accounted for 38 (60.3%) of the sample, while 25 (39.7%) were male. Most children were classified as ASA Physical Status I (39; 61.9%), whereas 24 (38.1%) were classified as ASA Physical Status II. Before the intervention, most respondents experienced severe anxiety (37; 58.7%), followed by

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moderate anxiety (23; 36.5%) and panic (3; 4.8%). After leaflet-based preoperative education, anxiety levels improved, with 20 respondents (31.7%) experiencing mild anxiety, 36 (57.1%) moderate anxiety, and only 7 (11.1%) severe anxiety, while no respondents remained in the panic category. The Wilcoxon signed-rank test indicated a statistically significant reduction in anxiety levels following the intervention ($p < 0.001$).

DISCUSSION

The characteristics of the respondents in this study showed that the majority of respondents were female (60.3%), aged 9 and 10 years (20.6%), and had an ASA physical status of I (61.9%). Girls tend to have a higher risk of anxiety than boys because they are more expressive in expressing emotions and fears (Atawaton, Pademme, & Banna, 2021). Respondents of school age (6-12 years) are still vulnerable to experiencing anxiety when facing medical procedures because their coping skills have not yet developed optimally (Prayogi, Atikah, Susana, & Induniasih, 2022). The majority of respondents also fell into the ASA I category, indicating good physical health. Most respondents were included in the ASA I category (Adelia, Burhan, & Yanti, 2025). However, optimal physical conditions do not necessarily eliminate preoperative anxiety because anxiety is also influenced by psychological factors, perceptions of surgical procedures, and individual characteristics of the child (Mustafa et al., 2024).

Before receiving education using the interactive pop-up book, the majority of respondents were in the severe anxiety category (58.7%). This high level of anxiety indicates that paediatric patients still have limited understanding of the surgical procedures they will undergo. Lack of information received by children regarding medical procedures can increase the perception of threat and trigger anxiety (Christiani et al., 2026). Most children experience anxiety in the preoperative phase due to unfamiliarity with medical procedures and fear of invasive procedures (Prayogi et al., 2022). Temporary separation from parents and an unfamiliar hospital environment can also exacerbate anxiety responses in children (Supangat et al., 2024).

After receiving education using interactive pop-up books, the distribution of anxiety levels showed positive changes. Most respondents were in the

moderate anxiety category (57.1%) and mild anxiety (31.7%), while the proportion of respondents with severe anxiety decreased to 11.1%. Furthermore, there were no more respondents in the panic category. This decrease in anxiety levels indicates that education using interactive pop-up books can help children better understand surgical procedures. Three-dimensional visualizations in pop-up books can make it easier for children to understand medical information that was previously difficult. In addition to functioning as an educational medium (Khasanah, & Irmaningrum, 2022). Pop-Up books also provide a therapeutic distraction effect, helping to divert children's attention from their fear of surgery (Sulastris, Rohayati, & Febriaty, 2021). Physiologically, a better understanding of the procedure can reduce the perception of threat, thus decreasing the stress response. This reduced stress response can then create a more relaxed state and help reduce anxiety levels in children (Davita, 2025). Picture book-based interventions are effective in reducing anxiety in paediatric patients before medical procedures (Hasbyalloh, 2022).

The Wilcoxon test results showed a p -value < 0.05 , indicating a significant effect of interactive pop-up book education on preoperative anxiety levels in paediatric patients. Demonstrated that illustrated storytelling media is effective in reducing preoperative anxiety in children (Cordray, Patel, & Prickett, 2022). The use of visual and interactive educational media can improve children's understanding of medical procedures, thereby reducing fears arising from unfamiliarity with the procedures to be undertaken (Li & Lopez, 2017). Through interactive learning experiences, children can develop a more structured understanding of the stages of the procedure to be undertaken, thereby increasing their sense of control over the situation they face (Mustafa et al., 2024). This condition helps children align expectations with the reality of medical procedures, resulting in more adaptive emotional responses (Sarah & Manik, 2019).

Unlike previous studies that generally used illustrated stories or conventional educational media, this study utilized an interactive pop-up book that combines three-dimensional visual elements and active child involvement during the educational process. This approach not only helps children understand surgical procedures but also provides a more engaging learning experience that is appropriate

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for the cognitive developmental stage of school-aged children. These findings suggest that the use of interactive educational media has the potential to be an effective alternative non-pharmacological intervention in preparing children psychologically before surgery. The results of this study add to the scientific evidence regarding the use of interactive visual-based educational media as a strategy to reduce preoperative anxiety in school-age paediatric patients (Rahmania, Apriliyani, & Kurniawan, 2024).

CONCLUSION

Education using interactive pop-up books has been proven effective in reducing preoperative anxiety levels in school-aged children. Before the intervention, most respondents were in the severe anxiety category, whereas after the intervention, anxiety levels decreased, indicated by an increase in the proportion of respondents in the moderate and mild anxiety categories. The Wilcoxon test results showed a significant difference between anxiety levels before and after the education program, amounting to 0.000 ($p < 0.05$). These findings suggest that interactive pop-up books can be an alternative non-pharmacological intervention that helps improve children's understanding and psychological readiness for surgery.

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