



## THE EFFECT OF POP-UP BOOK MEDIA EDUCATION ON THE LEVEL OF KNOWLEDGE AND ATTITUDES ABOUT PUBERTY IN ADOLESCENT GIRLS

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**Abstract Background:** Interesting educational media such as pop-up books can help adolescents understand puberty in a fun and easy-to-understand way. Three-dimensional visualizations in pop-up books make information more interesting and less boring.

**Objectives:** This study aimed to determine the effect of education using pop-up books on the knowledge and attitudes of adolescent girls towards puberty.

**Method:** This study was a quantitative analytical study with a quasi-experimental approach involving an intervention group and a control group. The population for this study was early adolescents aged 10-13 years at SDN Salamnunggal 1 Elementary School in Leles Subdistrict, Garut Regency. The sampling technique used purposive sampling with 35 participants in the intervention group and 35 participants in the control group.

**Results:** Data analysis techniques included univariate analysis and bivariate analysis using the Paired T-test. The results of the study indicate a significant effect on adolescents knowledge and attitudes before and after receiving education, with a p-value <0.005.

**Conclusion:** This concludes that there is an effect of education using pop-up books about puberty on the knowledge and attitudes of adolescent girls. Based on the research results, it is recommended to start integrating material about puberty and reproductive health into teaching and learning activities. The use of engaging educational media such as pop-up books can be an effective means of conveying this material in an interactive manner.

Keywords: Adolescents, Attitude, Knowledge, Puberty, Pop-Up Book.

## BACKGROUND

Adolescents are a significant population globally, with 16% or approximately 1.3 billion of the world's population aged 10-19 years according to WHO. In Indonesia, the 2020 census data shows 67 million people (24%) adolescents aged 10-24 years.<sup>1</sup> Puberty, which begins at the age of 8-13 years for women and 9-14 years for men, is a critical period that requires special attention<sup>2</sup>.

However, adolescents' knowledge of reproductive health is still low, with 43.22% having low knowledge and only 19.50% having good knowledge.<sup>2</sup> BKKBN data shows that 84% of Indonesian adolescents aged 12-17 years have not received sex education, indicating that this topic is still considered taboo.<sup>3</sup> This situation is exacerbated by Indonesia's literacy level which ranks 72 out of 77 countries with a score of 359, well below the global average of 487.<sup>4</sup>

Lack of puberty knowledge impacts a variety of issues, including feelings of shame (60% of adolescent girls feel embarrassed by breast growth), anxiety (43.6% of adolescent girls experience anxiety), and risky behaviors such as premarital sex which reaches 8.26% in adolescent boys and 4.17% in adolescent girls.<sup>5</sup>

Garut Regency faces a serious problem with 538 cases of child marriage in 2023.<sup>6</sup> The preliminary study at SDN Salamnunggal 1, Leles Subdistrict showed that 47 out of 71 female students in grades IV-VI did not know the changes of early puberty and felt confused, afraid, and embarrassed to face their first menstruation.

Health education has proven effective in increasing students knowledge about puberty by 91%.<sup>7</sup> Pop-up book media showed high effectiveness in health education, with a feasibility level of 91.14% and was able to increase children's sexual knowledge by 94.6%.<sup>8</sup> This media is also effective in increasing knowledge (91.5%), attitudes (92.4%), and personal hygiene skills (90.4%) in elementary school children.<sup>9</sup>

Based on these problems, an effective educational intervention using pop-up book media is needed to improve the knowledge and attitudes of adolescent girls about puberty, especially in areas with high rates of early marriage such as Garut Regency.

## METHODS

### ***Study setting and design***

This study used a quantitative approach with a quasi-experimental design in the form of Nonequivalent (Pretest and Posttest) Control Group Design. The study was conducted on two groups selected non-randomly, namely the intervention group who received education using pop-up book media and the control group who received education using leaflet media.

### ***Study population and sampling procedure***

The research was conducted at SDN Salamnunggal 1, Leles District, Garut Regency on June 5-14, 2025. The target population is all students at SDN Salamnunggal 1 as many as 133 people, with an affordable population of grade IV-VI students totaling 71 people. Inclusion criteria include students aged 10-13 years and willing to become respondents, while exclusion criteria are students who have received puberty education before and are not present during the study.

The sample size was calculated using the unpaired numerical analytic formula with the results of 35 samples for each group. The sampling technique used non probability sampling with purposive sampling method based on predetermined criteria. The independent variable is education with puberty pop-up book media, while the dependent variable is the knowledge and attitude of adolescent girls about puberty.

### ***Data Collection and Variable measurement***

The research instrument was a questionnaire consisting of knowledge questions using the Guttman Scale (True/False) and attitude questions using the Likert Scale (5 points). The questionnaire has gone through a validity test with a result of 0.334 and a reliability test with a Cronbach's Alpha value of 0.739. The pop-up book media has been validated by media

experts with a majority rating on a scale of 3-4. Data were collected through pretest, intervention 3 times a week face-to-face, and posttest. Data were analyzed using SPSS version 23 with univariate and bivariate analysis. Normality test using Shapiro Wilk, then analyze with unpaired t test if the data is normal or Mann-Whitney U test if it is not normal.

#### **Ethic Consideration**

The study has received ethical approval by observing the principles of informed consent, anonymity, confidentiality, autonomy, and justice.

## **RESULT AND DISCUSSION**

Table 1 showed the demographic data of the respondents. The level of exposure to puberty information, most respondents in both the experimental and control groups had less than one exposure. The experimental group had 31 respondents (88.5%) who had never or less than once received information related to puberty, and 4 respondents (11.5%) who had been exposed once. Meanwhile, the control group had 30 respondents (85.7%) with less than one exposure, and only 5 respondents (14.3%) who had been exposed to information about puberty once. This shows that both the experimental and control groups have a comparison of the effect of the educational intervention can be assessed more objectively.

Table 1. Demographic Characteristic of Respondents

| Demographic Characteristic    | Experiment Group |                | Control Group |                |
|-------------------------------|------------------|----------------|---------------|----------------|
|                               | Frequency        | Percentage (%) | Frequency (n) | Percentage (%) |
| (n)                           |                  |                |               |                |
| <b>Age</b>                    |                  |                |               |                |
| 11 y.o                        | 10               | 28,5           | 8             | 22,9           |
| 12 y.o                        | 17               | 48,6           | 16            | 45,7           |
| 13 y.o                        | 8                | 22,9           | 11            | 31,4           |
| Total                         | 35               | 100            | 35            | 100            |
| <b>Exposed to Information</b> |                  |                |               |                |
| Never                         | 31               | 88,5           | 30            | 85,7           |
| 1 time                        | 4                | 11,5           | 5             | 14,3           |
| Total                         | 35               | 100            | 35            | 100            |

Table 2 showed distribution of knowledge level before and after education. The results showed significant differences between the pop-up book and leaflet groups. The pop-up book group increased their knowledge score from 48.75 to 79.64, while the leaflet group only increased from 48.39 to 50.00. The Shapiro-Wilk normality test showed that the data were normally distributed ( $p>0.05$ ) in all groups.

Table 2. Distribution of knowlage lever before and after education

| Variable           | Min | Max | Mean  | SD     | p-value* |
|--------------------|-----|-----|-------|--------|----------|
| <b>Pop-Up Book</b> |     |     |       |        |          |
| Pretest            | 25  | 75  | 48.75 | 11.820 | 0.343    |
| Posttest           | 56  | 100 | 79.64 | 11.277 | 0.137    |
| <b>Leaflet</b>     |     |     |       |        |          |
| Pretest            | 19  | 69  | 48.39 | 11.578 | 0.231    |
| Posttest           | 31  | 69  | 50.00 | 9.344  | 0.104    |

\*Shapiro Wilk Test

Pop-up book media proved to be more effective in increasing puberty knowledge of adolescent girls compared to leaflets. The significant increase in scores (30.89 points) in the pop-up book group is in line with the research which shows the superiority of interactive visual media in menarche education.<sup>10</sup>

The low initial knowledge (48.75) is consistent with BKKBN 2019 data that 43.22%

of adolescents have low knowledge about reproductive health.<sup>3</sup> The advantage of pop-up books lies in 3D visualization that facilitates the understanding of abstract concepts to be concrete,<sup>11</sup> as well as its ability to dismantle false menstrual myths.

Supporting factors for effectiveness include interactive visual characteristics, suitability for developmental age, and repetition of material. Research by Nguyen, Camozzi & Sommer confirmed that self-directed visual education can increase knowledge by up to 12%. This finding has implications for the development of more effective reproductive education programs using visual-based media.<sup>12</sup>

Table 3. Distribution of attitude levels before and after being given education

| Variable           | Min | Max | Mean  | SD    | p-value* |
|--------------------|-----|-----|-------|-------|----------|
| <b>Pop-Up Book</b> |     |     |       |       |          |
| Pretest            | 53  | 87  | 68.80 | 9.301 | 0.140    |
| Posttest           | 76  | 100 | 87.50 | 5.990 | 0.312    |
| <b>Leaflet</b>     |     |     |       |       |          |
| Pretest            | 47  | 80  | 61.94 | 7.102 | 0.561    |
| Posttest           | 43  | 75  | 62.32 | 6.438 | 0.330    |

\*Shapiro Wilk Test

The pop-up book group showed a significant increase in attitude from 68.80 to 87.50. The leaflet group experienced a minimal increase from 61.94 to 62.32. The Shapiro-Wilk normality test showed normally distributed data ( $p>0.05$ ) in all groups.

The results showed that education using pop-up book media not only increased knowledge, but also significantly improved the attitude of adolescent girls in facing puberty.

Before the intervention, most respondents showed negative attitudes such as embarrassment with physical changes, anxiety with physical changes, and fear of first menstruation. The average score of the experimental group was 68.80, while the average score of the control group was 61.94. This finding is in line with Galifatma Sheffi Adina's research (2021) which revealed that before the intervention, most adolescents had attitudes that tended to be doubtful or negative regarding puberty information.<sup>13</sup>

After being given education through pop-up book media, there was a significant change in attitude to be more positive, with an increase in confidence in physical changes, acceptance of physical changes, and confidence about first menstruation. These results support the research which showed that the development of pop-up book media significantly increased learning outcomes and improved students' attitudes towards puberty.<sup>14</sup>

The success of pop-up book media in changing adolescent attitudes can be explained through its visual and interactive approach. Budianto, Gogor Bangsa & Christianna (2024) explained that direct interaction through pull and fold activities on pop-up books encouraged students to be more active in expressing their feelings and thoughts related to body changes, so that the initially hesitant attitude turned into deeper curiosity and acceptance.<sup>15</sup> Pop-up book media allows adolescents to more easily understand and accept sensitive information such as puberty, in line with research which shows a positive effect of pop-up book media on increasing knowledge of puberty in elementary school children.<sup>11</sup>

Factors that influence attitude change show that the support of the school environment, the active role of teachers, and parental involvement are very significant.<sup>13</sup> The study indicates that a supportive social and emotional environment can contribute greatly in shaping adolescents' attitudes to be more open to accepting changes that occur in their bodies, with an increase in positive attitudes reaching 69.2%. The intensity and frequency of media use also play an important role in the success of the intervention,

where the more often adolescents interact with educational materials in the form of pop-up books, the greater the increase in positive attitudes formed<sup>15</sup>.

Thus, education using pop-up book media is proven effective in shaping positive attitudes of adolescent girls towards pubertal changes. This positive attitude is important so that adolescents can undergo puberty with good psychological readiness and be able to make healthy adjustments.

Table 4. Results of the analysis of the effect of pop-up book education on the level of knowledge and attitudes of experimental and control groups

|           | Pop-up book       |          | Leaflet      |          | P-value** |
|-----------|-------------------|----------|--------------|----------|-----------|
|           | Mean± SD          | p-value* | Mean± SD     | p-value* |           |
| Knowledge | Pre 48.75± 11.820 | 0.001    | 48.39±11.578 | 0.499    | 0.899     |
|           | Post 79.64± 11.27 |          | 50.00±9.344  |          | 0.001     |
| Attitude  | Pre 68.850±9.301  | 0.001    | 61.94±7.102  | 0.800    | 0.001     |
|           | Post 87.50±5.990  |          | 62.32±6.438  |          | 0.001***  |

\*Dependent T-test

\*\*Independen T-test

\*\*\*Mann Whitney U test

The t-test results showed no significant difference between the experimental and control groups at pretest ( $p = 0.899$ ), indicating equal initial conditions. After the intervention, there was a significant difference in the posttest ( $p = 0.001$ ) with a mean difference of 29.643 points, where the experimental group experienced a significantly higher increase in knowledge than the control group.

The experimental group showed a significant increase in attitude from  $68.85 \pm 9.301$  to  $87.50 \pm 5.990$  ( $p = 0.001$ ). In contrast, the control group did not experience significant changes from  $61.94 \pm 7.102$  to  $62.32 \pm 6.438$  ( $p = 0.800$ ). The Mann-Whitney U test showed significant differences between groups in both pre-test and post-test ( $p = 0.001$ ).

The results showed that pop-up book media proved effective in increasing adolescent girls' knowledge about puberty. This media provides interactive visual, kinesthetic, and textual stimuli, making it easier to understand, especially for elementary school children.<sup>10</sup> The significant difference in knowledge scores between the pre-test and post-test in the experimental group indicates the effectiveness of pop-up book media compared to conventional leaflet media. The advantages of pop-up book media lie in the three-dimensional visual design and interactive elements such as parts that can be opened, pulled, and folded, creating a fun learning experience and increasing information absorption.<sup>15</sup> Previous research also confirmed that pop-up book media has high validity in delivering puberty material to students with significantly improved learning outcomes.<sup>16</sup>

Pop-up book media is not only effective in transferring knowledge, but also in shaping positive attitudes of adolescent girls towards puberty. The study showed a significant difference ( $p$ -value 0.001) between the group that received education using pop-up books and the control group.<sup>17</sup> This media is able to create deep emotional engagement through interactive visual design and age-appropriate narrative delivery. In contrast to leaflets that are passive and one-way, pop-up books stimulate active participation and stronger emotional engagement, which is key in forming positive attitudes towards puberty.<sup>18</sup> The pop-up book design is also able to reduce the awkwardness of adolescents in discussing the topic of puberty and make them more enthusiastic in receiving information that was previously considered taboo.

Practically, pop-up book media can bridge the understanding gap between educational materials and the cognitive abilities of adolescents, so that information becomes more easily accepted.<sup>19</sup> This effectiveness has also been proven in a broader context, such as in Personal Hygiene material, where the use of pop-up books increases understanding and shapes students' positive attitudes towards reproductive health issues.<sup>9</sup> Educational media with visual and interactive elements have a stronger effect in shaping attitudes and

behaviors than two-dimensional print media. This makes pop-up books an effective and interactive alternative media in adolescent reproductive health education, especially in preparing psychological and social readiness to face changes towards adulthood.

**Effect of Media Education on Knowledge and Attitude Change with the SOR Method.** The increase in knowledge and changes in attitude of adolescent girls towards puberty after being given education through pop-up book media can be explained using the Stimulus-Organism-Response (SOR) framework.<sup>20</sup> This model illustrates how a stimulus from the environment is received and processed internally (organism), resulting in a measurable behavioral or cognitive response (response).

In the context of this study, pop-up book media acted as an effective stimulus. Its visually appealing presentation through three-dimensional illustrations, bright colors, and interactive narratives increases the attractiveness and engagement of learners. These characteristics are very suitable for the cognitive and psychological development stages of adolescents, so that they are able to build attention and emotional involvement from the beginning of providing educational material.<sup>21</sup>

After receiving the stimulus, adolescents act as organisms that process information through two main pathways, namely cognitive and affective. The cognitive pathway includes the absorption of information about body changes during puberty, such as breast growth, first menstruation, and personal hygiene. This information is understood more easily because the pop-up book presents the material gradually, logically, and structured.<sup>22</sup>

This internal process eventually produces a response in the form of increased knowledge and the formation of a more positive attitude towards puberty. Adolescents who previously felt confused or embarrassed began to show acceptance, openness, and readiness in facing physical changes. Pop-up book media is more effective than leaflets in increasing adolescent girls knowledge about menarche because the approach is visual and easy to understand.<sup>23</sup>

Previous research shows that the use of pop-up book media significantly improves the skills and knowledge of elementary school students in tooth brushing practices, proving that visual media such as pop-up books can trigger cognitive and affective changes simultaneously.<sup>21</sup> This media is also effective in improving the knowledge and attitudes of adolescents with intellectual disabilities related to reproductive health through media that is friendly, interesting, and easy to understand.<sup>22</sup>

Thus, the SOR model provides a strong theoretical basis in explaining the mechanism of changes in adolescents' knowledge and attitudes towards puberty. Visual-based educational media such as pop-up books are proven to be an effective stimulus in triggering internal processing and generating positive responses. This approach is very useful to be used in reproductive health education, especially in the adolescent age group that requires media that is in accordance with their developmental characteristics.

## **CONCLUSION**

Health education using pop-up book media is proven to be an effective approach in increasing knowledge and shaping the attitudes of adolescent girls related to puberty. This visual and interactive media is able to attract attention and facilitate adolescents' understanding of the material presented. This study shows that pop-up books act as an educational stimulus in accordance with the Stimulus-Organism-Response (SOR) theory, where visual stimuli from the media activate the thinking and emotional processes in adolescents, resulting in meaningful changes in attitudes and increased knowledge. Therefore, pop-up book media deserves to be used as an innovative and fun educational alternative, especially in reproductive health education for elementary school-age children, especially in areas with low literacy levels.

## COMPETING INTERESTS

All authors had none to declare

## AUTHOR'S CONTRIBUTION

All authors contributed to the final manuscript.

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