

Development of a QR Code-Integrated Hybrid Pop-Up Book Educational Media (POPAN 3D) as a Learning Tool to Improve Oral Health Maintenance Behavior Among Elementary School Students

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Publication Date: 2026/08/04

Abstract: The high prevalence of oral health problems among elementary school children highlights the need for more interactive educational media to support learning and promote positive oral health maintenance behaviors. Therefore, a QR Code-Integrated Hybrid Pop-Up Book Educational Media (POPAN 3D) was developed by integrating a three-dimensional pop-up book, animated videos, and educational games. To develop a QR Code-Integrated Hybrid Pop-Up Book Educational Media (POPAN 3D) as a learning tool to improve oral health maintenance behavior among elementary school students. This study employed a Research and Development (R&D). Data were collected through interviews, observations, and questionnaires. Media feasibility was evaluated using Aiken's V and the Intraclass Correlation Coefficient (ICC). The effectiveness of the media was assessed using a quasi-experimental pretest–posttest control group design involving 60 elementary school students. Data were analyzed using the Friedman test, Bonferroni-corrected post hoc test, and the Mann–Whitney test. POPAN 3D was found to be valid and reliable, with an Aiken's V value of 0.95 and an ICC value of 0.850. The POPAN 3D educational media was found to be valid and reliable, with an Aiken's V value of 0.95 and an ICC of 0.850. The post hoc analysis demonstrated that POPAN 3D significantly improved knowledge ($p = 0.012$), attitudes ($p = 0.000$), and skills ($p = 0.003$) related to oral health maintenance. The Mann–Whitney U test showed that improvements in knowledge ($p = 0.008$), attitudes ($p = 0.000$), and skills ($p = 0.000$) were significantly greater in the intervention group than in the control group. The QR Code-Integrated Hybrid Pop-Up Book Educational Media (POPAN 3D) is valid, reliable, and effective in improving elementary school students' knowledge, attitudes, and skills related to oral health maintenance. Compared with conventional flipchart media, POPAN 3D produced significantly greater improvements in the intervention group than in the control group.

Keywords: POPAN 3D, Hybrid Pop-Up Book, QR Code, Oral Health, Elementary School Students.

How to Cite: Ema Susiana Rahmadhani; Ari Suwondo; Bambang Sutomo; Lanny Sunarjo; Edy Susanto (2026) Development of a QR Code-Integrated Hybrid Pop-Up Book Educational Media (POPAN 3D) as a Learning Tool to Improve Oral Health Maintenance Behavior Among Elementary School Students. *International Journal of Innovative Science and Research Technology*, 11(7), 2731-2741. <https://doi.org/10.38124/ijisrt/26jul1610>

I. INTRODUCTION

Dental and oral health issues remain a major public health challenge in Indonesia. The Health Development Policy Agency (BKPK), through the 2023 Indonesia Health Survey (SKI), has identified dental and oral health indicators as part of efforts to achieve the Sustainable Development Goals (SDGs), particularly Goal 3 on good health and well-being. In line with this, the government has also launched the “Caries-Free Indonesia 2030” Program, which focuses on strengthening

promotive and preventive efforts by fostering healthy oral hygiene habits starting in school-age children. [1,2].

Although various programs have been implemented, the prevalence of oral health problems in Indonesia remains relatively high. Data from the 2023 SKI show that 56.9% of the population aged ≥ 3 years experience oral health problems, while among the 5–9-year-old age group, the figure reaches 62.6%. Furthermore, the prevalence of dental caries remains as high as 82.8% nationwide and 84.8% among children aged 5–9

years. These conditions are influenced by low oral health literacy, high sugar consumption, and suboptimal oral hygiene practices. Although the majority of children brush their teeth daily, only a small proportion do so at the correct times and using the proper technique. [1,3]

Dental health-promoting behaviors are influenced by an individual's knowledge, attitudes, and beliefs regarding the importance of disease prevention. The Health Belief Model (HBM) explains that a person will engage in preventive actions if they perceive a low level of vulnerability, a low severity of the disease, high benefits of the action, and low barriers to that behavior. Therefore, educational interventions capable of fostering positive perceptions toward oral health maintenance are a key factor in shaping healthy behaviors among school-aged children. [4]

Various studies indicate that interactive learning media, such as pop-up books, effectively enhance oral health knowledge among elementary school students because they create a more engaging learning experience compared to conventional methods. [5,6] However, the educational media currently in use—such as lectures, leaflets, posters, and flipcharts—remain one-way in nature, resulting in relatively low levels of active student engagement. Based on Edgar Dale's Cone of Experience theory, learning media that provide multisensory and more concrete learning experiences are more effective in enhancing knowledge, shaping attitudes, and developing skills. [7]

Based on these conditions, the QR Code-Integrated Hybrid Pop-Up Book Educational Medium (POPAN 3D) was developed, combining a three-dimensional pop-up book, QR code-based animated videos, educational games, and interactive learning activities into a single medium. The integration of these various components is expected to increase student engagement and provide a more meaningful learning experience, thereby improving knowledge, attitudes, and skills related to maintaining oral health. To date, research on the development of hybrid media that integrates pop-up books, QR codes, animated videos, and educational games to improve oral health maintenance behaviors among elementary school students remains limited. Therefore, this study aims to develop and test the effectiveness of POPAN 3D as a dental and oral health educational medium that is more effective than conventional media in improving dental and oral health maintenance behaviors among elementary school students.

II. RESEARCH METHODS AND SAMPLE

This study employed a Research and Development (R&D) methodology using a mixed-methods approach, specifically a qualitative approach during the media development phase and a quantitative approach during the product effectiveness testing phase. The development model is based on Borg and Gall's framework, modified into five stages: (1) information gathering, (2) media design, (3) expert validation, (4) product pilot testing, and (5) product outcome testing. The product outcome testing stage used a quasi-experimental pretest–posttest control group design to evaluate the effectiveness of the QR Code-Integrated Hybrid Pop-Up

Book Educational Media (POPAN 3D) in changing elementary school students' oral health behaviors. Measurements were taken at three time points: the pretest, posttest 1 immediately after the intervention, and posttest 2 two weeks after the intervention to assess the retention of behavioral changes. The intervention group received education using the POPAN 3D medium, while the control group received education using a flipchart. Media feasibility analysis was performed using Aiken's V and the Intraclass Correlation Coefficient (ICC). Effectiveness analysis utilized post hoc tests with Bonferroni correction, as well as the Mann–Whitney test to compare changes between the intervention and control groups. [8,9]

The study population consisted of fourth- and fifth-grade students at SDN 012 Kuantan Sako and SDN 010 Kuantan Sako, Logas Tanah Darat Subdistrict, Kuantan Singingi Regency, Riau Province. The study sample comprised 60 students, consisting of 30 students in the intervention group and 30 students in the control group, who were selected using purposive sampling in accordance with the study's inclusion and exclusion criteria. During the media development phase, the study also involved the Head of the Community Health Center, a dentist, and the School Health Unit (UKS) coordinator as informants during the information-gathering stage, as well as subject matter experts, media experts, and education experts to assess the media's suitability prior to the pilot test. The study was conducted in March 2026 at SDN 012 Kuantan Sako and SDN 010 Kuantan Sako. [9,10]

III. RESULTS

➤ *Popan 3D Information Collection Result*

Data was collected through interviews with the head of the community health center, a dentist, and the School Health Unit (UKS) coordinator at the Sukaraja Community Health Center in Logas Tanah Darat Subdistrict, Kuantan Singingi Regency, Riau Province.

Data collection was conducted through interviews with the Community Health Center Director (R1), a dentist (R2), and the UKS coordinator (R3) to identify the need for developing oral health education materials for 4th–5th-grade elementary school students. The interview results showed that students generally already possess basic knowledge of oral health; however, they still face difficulties in translating that knowledge into correct and sustainable behavior. This is evident from the continued occurrence of cavities, dental caries, and plaque buildup, as well as students' lack of understanding regarding proper toothbrushing techniques.

Dental and oral health topics considered important to teach students include proper toothbrushing techniques, maintaining dental and oral hygiene, choosing foods that are good for dental health, the causes of cavities, and the importance of regular dental checkups. Dental and oral health education has so far been conducted through UKGS activities and outreach programs, but it still faces challenges such as a shortage of health personnel, limited educational resources, and the low appeal of the teaching methods used. Experts also note that current educational materials have not been effective in capturing students' attention or enhancing their understanding to the fullest extent.

Therefore, there is a need for educational media that is engaging, easy to understand, interactive, and capable of actively involving students in the learning process. The development of the Hybrid Pop-Up Book Educational Media Integrated with QR Codes (POPAN 3D) is considered beneficial for supporting oral health education because it aligns with the characteristics of elementary school students and effectively integrates visual media, activities, and digital technology.

➤ Model Design and Development

Based on the information gathered, the QR Code-Integrated Hybrid Pop-Up Book Educational Medium (POPAN 3D) was developed as a learning tool to improve oral health habits among elementary school students. The development of this resource was tailored to the characteristics and needs of students through several stages, including content development, storyboard creation, 3D pop-up visual design, animated video production, QR code integration, and the design of interactive activities. The content presented covers an introduction to the structure and function of teeth, oral hygiene, proper toothbrushing techniques, and dietary habits that support dental health.

The POPAN 3D educational materials are designed with colorful illustrations, engaging characters, and three-dimensional pop-up elements to stimulate students' interest in learning. Each topic is supported by an animated video accessible by scanning a QR code with a smartphone, thereby integrating print and digital media. In addition, the materials include interactive activities and educational games, such as identifying the parts of a tooth, distinguishing between healthy and unhealthy teeth, recognizing dental hygiene tools, and practicing proper toothbrushing techniques. This approach is expected to increase student engagement in the learning process and facilitate their understanding of oral health topics.

➤ Expert Validation

Expert validation in this study involved three experts with expertise in their respective fields: a media expert, a dentist, and an expert in elementary school teacher education. The data from the experts' evaluations were analyzed using Aiken's V and the Intraclass Correlation Coefficient (ICC) as follows:

• Validity Test

Tabel 1 Expert Validation POPAN 3D

Item	Validity Score	Interpretation
Item 1	1,00	Very High
Item 2	1,00	Very High
Item 3	0,83	Very High
Item 4	0,92	Very High
Item 5	0,92	Very High
Item 6	0,83	Very High
Item 7	1,00	Very High
Item 8	1,00	Very High
Item 9	1,00	Very High
Item 10	1,00	Very High
Item 11	0,92	Very High
Item 12	1,00	Very High
Item 13	0,83	Very High
Item 14	1,00	Very High
Item 15	1,00	Very High
Item 16	1,00	Very High
Average Total Score = 0.95		

Table 1 shows the results of the assessment by three experts; the expert validity test yielded an average validity score of 0.95, indicating very high validity.

Table 2 Expert Validity Test Using ICC

	Interclass Correlation Coefficient (ICC)	Sig
Single Measure	0.600 ^a	0,001
Average Measure	0.850 ^c	0,001

Intraclass Correlation Coefficient (ICC)

Table 2 The results show a single-measure reliability coefficient of 0.600a. This value is above the minimum threshold of 0.50, indicating that the reliability of the assessments by each expert meets the required criteria. In addition, the average measure was 0.850 with a significance value of 0.000. Since this ICC value is greater than 0.80, it can be concluded that the level of agreement among the

experts is very high and that the instrument used has good reliability.

➤ Product Result

This pilot study was conducted at Elementary School 012 Kuantan Sako and Elementary School 010 Kuantan Sako, with schoolchildren as the intervention and control groups.

Table 3 Frequency Distribution of Students' Knowledge Levels in the Control Group

Knowledge	Control					
	Pre		Post 1		Post 2	
	n	%	n	%	n	%
Good	4	13,3	6	20,0	6	20,0
Fair	16	53,3	22	73,3	14	46,7
Poor	10	33,3	2	6,7	10	33,3
Total	30	100	30	100	30	100

Table 3 Regarding the distribution of students' knowledge levels in the control group prior to the treatment, the majority of respondents—16 (53.3%)—were in the “fair” category, followed by 10 (33.3%) in the “poor” category, and the smallest group—4 (13.3%)—in the “good” category. After the intervention, the results of Post-Test 1 showed an improvement; however, the largest number of respondents still fell into the

“adequate” category, totaling 22 (73.33%), followed by the “good” category with 9 (20.0%), and the lowest number in the “poor” category, totaling 2 (6.7%). In the final post-test 2 results, the largest number of respondents fell into the “fair” category, with 14 (46.7%), followed by the “poor” category with 10 students (33.3%), while the “good” category had the fewest respondents, at 6 (20.0%).

Table 4 Frequency Distribution of Students' Knowledge Levels in the Intervention Group

	Intervention					
	Pre		Post 1		Post 2	
	n	%	n	%	n	%
Good	7	23,3	11	36,7	9	30,0
Fair	14	46,7	19	63,3	20	66,7
Poor	9	30,0	0	0,0	1	3,3
Total	30	100	30	100	30	100

Table 4 In the intervention group, before the intervention was administered, most respondents had the highest level of knowledge in the “adequate” category, with 14 (46.7%); 7 (23.3%) were in the “good” category; and 9 (30.0%) were in the “poor” category. After the intervention was administered, the results of Post-Test 1 showed that the majority of respondents were in the “adequate” category (19, or 63.3%),

While 11 (36.7%) were in the “good” category, and 0 (0%) were in the “poor” category. The final results from Post-Test 2 showed that the majority of respondents were still in the “adequate” category, totaling 20 (66.7%), followed by the “good” category with 9 (30.0%), and the “poor” category with 1 (3.3%).

Table 5 Frequency Distribution of Attitudes Toward Oral Health Care in the Control Group

Attitudes	Control					
	Pre		Post 1		Post 2	
	n	%	n	%	n	%
Good	3	10,0	8	26,7	2	6,7
Fair	23	76,7	19	63,3	24	80,0
Poor	4	13,3	3	10,0	4	13,3
Total	30	100	30	100	30	100

Table 5 pada kelompok kontrol, sebelum perlakuan responden terbanyak dalam kategori cukup dengan jumlah 23 (76,7%), disusul kategori kurang dengan responden sebanyak 4 (13,3%), dan kategori dengan responden terendah yaitu baik sebanyak 3 (10,0%). Setelah perlakuan, hasil post test 1 menunjukkan peningkatan, namun responden terbanyak masih dalam kategori cukup sebanyak 19 (63,3%), diikuti kategori

baik sebanyak 8 (26,7%), dan terendah pada kategori kurang sebanyak 2 (6,7%). Hasil pengukuran akhir post test 2 responden terbanyak pada kategori cukup sebanyak 24 (63,3%), lalu kategori kurang sebanyak 4 siswa (13,3%), sementara kategori baik dengan responden terendah yaitu sebanyak 2 (6,7%).

Table 6 Frequency Distribution of Attitudes Toward Oral Health Care in the Intervention Group

Attitudes	Intervensi					
	Pre		Post 1		Post 2	
	n	%	n	%	n	%
Good	7	23,3	9	30,0	8	26,7
Fair	17	56,7	19	63,3	19	63,3
Poor	6	20,0	2	6,7	3	10,0
Total	30	100	30	100	30	100

Table 6 The results for the intervention group before the intervention showed that most respondents had the highest level of knowledge in the “adequate” category, with 17 (56.7%); the “good” category, with 7 (23.3%); and the “poor” category, with 6 (20.0%). After the intervention was administered, the results of Post-Test 1 showed that the majority of respondents were in

the “adequate” category (19, or 63.3%), while 9 (30.0%) were in the “good” category, and 2 (6.7%) were in the “poor” category. The final results from Post-Test 2 showed that the majority of respondents were still in the “adequate” category (19, or 63.3%), followed by the “good” category (9, or 26.7%), and the “poor” category (3, or 10.0%).

Table 7 Frequency Distribution of Oral Health Maintenance Skills in the Control Group

Skills	Control					
	Pre		Post 1		Post 2	
	n	%	n	%	n	%
Good	0	0,0	4	13,3	2	6,7
Fair	21	70,0	22	73,3	18	60,0
Poor	9	30,0	4	13,3	10	33,3
Total	30	100	30	100	30	100

Table 7 Frequency distribution of students’ skills: In the control group, prior to the intervention, the majority of respondents—21 (70.0%)—had a knowledge level in the “fair” category, followed by 9 (30.0%) in the “poor” category, and 0 (0%) in the “good” category. After the intervention, the results of Post-Test 1 showed an improvement; however, the majority

of respondents were still in the fair category, totaling 22 (73.3%), followed by the good category with 4 (13.3%), and the poor category with 4 (13.3%). In the final post-test 2 results, the majority of respondents were still in the fair category, totaling 18 (60.0%), followed by the poor category with 10 (33.3%), and the lowest number in the good category at 2 (6.7%).

Table 8 Frequency Distribution of Oral Health Maintenance Skills in the Intervention Group

Skills	Intervention					
	Pre		Post 1		Post 2	
	n	%	n	%	n	%
Good	6	20,0	13	43,3	7	23,3
Fair	12	40,0	16	53,3	20	66,7
Poor	12	40,0	1	3,3	3	10,0
Total	30	100	30	100	30	100

Table 8 In the intervention group, prior to the intervention, most respondents had skill levels in the “poor” category (12, or 40.0%), the “fair” category (12, or 40.0%), and the “good” category (6, or 20.0%). After the intervention was administered, the results of Post-Test 1 showed that the majority of respondents were in the fair category (16, or

53.3%), while 13 (43.3%) were in the good category, and 1 (3.3%) remained in the poor category. The final results from Post-Test 2 showed that the largest number of respondents were still in the “adequate” category, totaling 20 (66.7%), followed by the “good” category with 7 (23.3%), and the “poor” category with 3 (10.0%).

Table 9 Comparison of the Difference in Mean Values (Δ) Between the Control Group and the Intervention Group

Variable	Average Difference (Δ)			
	Control Group		Intervention Group	
	Pre -Post Test 1	Post Test 1-Post Test 2	Pre-Post Test 1	Post Test 1-Post Test 2
Knowledge	7,27	-1,83	9,63	-0,10
Attitudes	11,40	-1,50	17,77	-0,57
Skills	6,77	-1,20	11,17	-0,53

Table 9 The average difference (Δ) in knowledge scores in the control group was 7.27 from the pre-test to post-test 1 and -1.83 from post-test 1 to post-test 2. Meanwhile, in the intervention group, the mean difference in knowledge scores was 9.63 from the pre-test to post-test 1 and -0.10 from post-test 1 to post-test 2. The mean difference between the control group and the intervention group for knowledge scores was 9.03 from the pre-test to post-test 1 and -1.70 from post-test 1 to post-test 2.

For the attitude variable, the mean difference in scores in the control group was 11.40 from the pre-test to post-test 1 and -1.50 from post-test 1 to post-test 2. In the intervention group, the difference in mean attitude scores was 17.77 from the pre-

test to post-test 1 and -0.57 from post-test 1 to post-test 2. The average difference between the control group and the intervention group was 12.77 from the pre-test to post-test 1 and -1.23 from post-test 1 to post-test 2.

For the skill variable, the average score difference in the control group was 6.77 from the pre-test to post-test 1 and -1.20 from post-test 1 to post-test 2. In the intervention group, the difference in average skill scores was 11.17 from the pre-test to post-test 1 and -0.53 from post-test 1 to post-test 2. Meanwhile, the average difference between the control group and the intervention group was 7.97 from the pre-test to post-test 1 and -0.73 from post-test 1 to post-test 2.

Table 10 Distribution of the Mean, Standard Deviation (SD), and Change (Δ) in Knowledge Scores

Variable	Variable	Mean $\pm$ SD PreTest	Mean $\pm$ SD Post Test 1	$\Delta \pm$ SD
Knowledge	Control	7,60 $\pm$ 2,44	14,87 $\pm$ 1,87	7,27 $\pm$ 2,54
	Intervention	8,63 $\pm$ 3,12	18,26 $\pm$ 1,36	9,63 $\pm$ 0,65

Table 10 The average knowledge score in the control group on the pre-test was 7.60 ± 2.44 and increased to 14.87 ± 1.87 on post-test 1, with a difference in change (Δ) of 7.27 ± 2.54 . Meanwhile, in the intervention group, the average knowledge score at the pre-test was 8.63 ± 3.12 and increased to 18.26 ± 1.36 at post-test 1, with a change difference (Δ) of 9.63 ± 0.65 .

These results indicate that both groups experienced an increase in their average knowledge scores after receiving the education. However, the intervention group had a higher average post-test 1 score and a larger difference in change (Δ) compared to the control group.

Table 11 Distribution of the Mean, Standard Deviation (SD), and Change (Δ) in Attitude Scores

Variable	Group	Mean $\pm$ SD Pre Test	Mean $\pm$ SD Post Test 1	$\Delta \pm$ SD
Attitude	Control	15,57 $\pm$ 3,02	26,97 $\pm$ 2,77	11,40 $\pm$ 4,39
	Intervention	15,93 $\pm$ 1,93	33,70 $\pm$ 3,00	17,77 $\pm$ 3,92

Table 11 The average attitude score in the control group was 15.57 ± 3.02 on the pre-test and increased to 26.97 ± 2.77 on post-test 1, with a difference in change (Δ) of 11.40 ± 4.39 . Meanwhile, in the intervention group, the mean attitude score at the pre-test was 15.93 ± 1.93 and increased to 33.70 ± 3.00 at post-test 1, with a change difference (Δ) of 17.77 ± 3.92 . These data indicate that both groups experienced an increase in

their mean attitude scores after receiving the education. However, the intervention group had a higher average post-test 1 score than the control group. Additionally, the difference in change (Δ) in attitude scores in the intervention group was also greater than that in the control group, indicating a greater change in attitude following the intervention.

Table 12 Distribution of Mean, Standard Deviation (SD), and Change (Δ) in Skill Scores

Variabel	Group	Mean $\pm$ SD Pre Test	Mean $\pm$ SD Post Test 1	$\Delta \pm$ SD
Skill	Control	7,27 $\pm$ 1,74	14,03 $\pm$ 1,94	6,77 $\pm$ 2,79
	Intervention	8,23 $\pm$ 3,23	19,40 $\pm$ 0,55	11,17 $\pm$ 3,23

Table 12 The average skill score in the control group on the pre-test was 7.27 ± 1.74 and increased to 14.03 ± 1.94 on the first post-test, with a difference in change (Δ) of 6.77 ± 2.79 . Meanwhile, in the intervention group, the average skill score at the pre-test was 8.23 ± 3.23 and increased to 19.40 ± 0.55 at post-test 1, with a difference in change (Δ) of 11.17 ± 3.23 . These results indicate that there was an increase in the average

skill scores in both groups after receiving the education. However, the intervention group had a higher average post-test 1 score than the control group. In addition, the difference in change (Δ) in skill scores in the intervention group was greater than that in the control group, indicating a greater improvement in skills following the intervention.

Table 13 Results of the Test of Differences in Knowledge Scores Before and After the Intervention

Variabel	Group	$\Delta \pm$ SD	p-value
Knowledge	Control	7,27 $\pm$ 2,54	0.019
	Intervention	9,63 $\pm$ 0,65	0.012

Table 13 In the control group, the mean difference (Δ) in knowledge scores was 7.27 ± 2.54 , with a p-value of 0.019. Meanwhile, in the intervention group, the mean difference (Δ) in knowledge scores was 9.63 ± 0.65 , with a p-value of 0.012. Based on the results of the post hoc test with Bonferroni correction ($p < 0.0167$), the change in knowledge scores in the intervention group showed a statistically significant difference between pre- and post-intervention ($p = 0.012$). In contrast, the

change in knowledge scores in the control group did not show a statistically significant difference ($p = 0.019$). In addition to having a larger mean difference in change, the intervention group also showed a significant change following the use of the POPAN 3D media. These results indicate that the POPAN 3D media is more effective in improving knowledge of oral health maintenance than the flipchart media.

Table 14 Results of the Test of Differences in Attitude Scores Before and After the Intervention

Variabel	Group	$\Delta \pm$ SD	p-value
Attitude	Control	11,40 $\pm$ 4,39	0.000
	Intervention	17,77 $\pm$ 3,92	0.000

Table 14 In the control group, the mean difference (Δ) in attitude scores was 11.40 ± 4.39 , with a p-value < 0.000 . Meanwhile, in the intervention group, the mean difference (Δ)

in attitude scores was 17.77 ± 3.92 , with a p-value < 0.000 . Based on the results of the post hoc test with Bonferroni correction ($p < 0.0167$), changes in attitude scores in both the

control and intervention groups showed significant differences between pre- and post-intervention. This is indicated by p-values in both groups that were smaller than the predetermined significance threshold. Furthermore, the intervention group had

a larger mean change (Δ) than the control group, indicating that the increase in attitude scores in the intervention group was greater following the educational program.

Table 15 Results of the Test of Differences in Skill Scores Before and After the Intervention

Variable	Group	$\Delta \pm SD$	p-value
Skill	Control	6,77 $\pm$ 2,79	0.029
	Intervention	11,17 $\pm$ 3,23	0.003

Table 15 In the control group, the mean difference (Δ) in skill scores was 6.77 $\pm$ 2.79, with a p-value of 0.029. Meanwhile, in the intervention group, the mean difference (Δ) in skill scores was 11.17 $\pm$ 3.23, with a p-value of 0.003. Based on the results of the post hoc test with Bonferroni correction ($p < 0.0167$), the change in skill scores in the intervention group showed a statistically significant difference between pre- and post-intervention ($p = 0.003$). In contrast, no statistically

significant difference was found in the control group ($p = 0.029$). In addition to having a larger mean difference in change (Δ), the intervention group also showed a significant improvement in skills following the educational session using the POPAN 3D medium. These results indicate that a meaningful change in skills occurred only in the intervention group.

Table 16 A Comparison of the Effectiveness of 3D POPAN Media and Flipchart Media

Variable	Kelompok	$\Delta \pm SD$	P-Value
Knowledge	Control	7,27 $\pm$ 2,54	0.008*
	Intervention	9,63 $\pm$ 0,65	
Attitude	Control	11,40 $\pm$ 4,39	0.000*
	Intervention	17,77 $\pm$ 3,92	
Skill	Control	6,77 $\pm$ 2,79	0.000*
	Intervention	11,17 $\pm$ 3,23	

*Mann–Whitney Test**

Table 16 The results of the Mann–Whitney test showed a p-value of 0.008 for the knowledge variable. This value is less than 0.05, indicating a significant difference in effectiveness between the 3D POPAN medium and the flipchart medium in improving students' knowledge of oral health care. The mean difference (Δ) in knowledge scores for the intervention group was 9.63 $\pm$ 0.65, which was higher than that of the control group at 7.27 $\pm$ 2.54.

For the attitude variable, a p-value of 0.000 ($p < 0.05$) was obtained, indicating a significant difference in effectiveness between the 3D POPAN medium and the flipchart medium. The mean difference (Δ) in attitude scores in the intervention group was 17.77 $\pm$ 3.92, which was higher than that of the control group at 11.40 $\pm$ 4.39.

For the skill variable, the Mann–Whitney test yielded a p-value of 0.000 ($p < 0.05$), indicating a significant difference in effectiveness between the two media. The mean difference (Δ) in skill scores for the intervention group was 11.17 $\pm$ 3.23, which was higher than that of the control group at 6.77 $\pm$ 2.79.

These results indicate that the POPAN 3D medium produced a greater increase in knowledge, attitude, and skill scores compared to the flipchart medium. Thus, it can be concluded that the POPAN 3D medium is more effective than the flipchart medium in improving students' knowledge, attitudes, and skills regarding oral health maintenance.

IV. DISCUSSION

➤ Information Collection

The results of the data collection show that elementary school students already possess basic knowledge of oral health but are not yet able to apply it optimally in their daily behavior. This is evidenced by the persistently high incidence of dental caries and dental plaque, as well as students' limited understanding of proper toothbrushing techniques. These findings indicate that increasing knowledge alone is not sufficient to change oral health behavior. These results are consistent with the study by Akbar et al., which states that innovative educational media are needed to support changes in oral health behavior among elementary school students [12].

Furthermore, interviews with the Head of the Community Health Center, dentists, and UKS coordinators revealed that the implementation of the UKGS program is still hampered by a shortage of health personnel, a lack of learning materials, and unengaging educational methods. These conditions result in suboptimal student engagement in the learning process. Previous research has also shown that interactive educational media tailored to children's characteristics are more effective in improving attention, understanding, and oral health behaviors compared to conventional methods [13].

Based on these needs, the QR Code-Integrated Hybrid Pop-Up Book Educational Medium (POPAN 3D) was developed, combining three-dimensional visuals, interactive activities, and video access via QR codes. This integration of print and digital media is expected to increase student

engagement and the effectiveness of dental health education, as supported by previous research on the effectiveness of QR code-assisted pop-up books. [12]

➤ *Feasibility and Validity Analysis of the QR Code-Based 3D POPAN Media*

The validation results show that the POPAN 3D learning medium has a very high level of validity (91.25%), supported by Aiken's V and the Intraclass Correlation Coefficient (ICC), which indicate good content validity and inter-rater reliability. These findings are consistent with previous research stating that learning media with a validity score above 0.80 are suitable for use in the learning process and capable of comprehensively fulfilling learning objectives [14–17].

The POPAN 3D media was developed by integrating a three-dimensional pop-up book, interactive activities, and a QR code linked to an animated video. This combination of print and digital media provides a more concrete, engaging learning experience that is well-suited to the characteristics of elementary school students. This approach aligns with constructivist theory, which emphasizes that knowledge is constructed through active learning experiences, and is supported by research showing that interactive media can enhance student engagement and understanding compared to conventional teaching methods. [18–20].

In addition, the integration of QR codes allows students to access learning materials independently through animated videos, making the learning process more flexible and engaging. These findings are supported by research showing that the use of digital technology in learning media can improve student motivation, learning outcomes, and skills [21–23]. Thus, the POPAN 3D media is considered suitable for use as an innovation in oral health education to enhance the effectiveness of education for elementary school students.

➤ *Product Result Test*

• *Analysis of Differences in Knowledge Scores Before and After the Intervention*

The results of the study showed that the intervention group, which received education using the Hybrid Pop-Up Book with Integrated QR Codes (POPAN 3D), experienced a greater increase in knowledge compared to the control group, which used flipcharts. This is indicated by the mean difference (Δ) in knowledge scores, which was 9.63 ± 0.65 in the intervention group and 7.27 ± 2.54 in the control group. The results of the post hoc test with Bonferroni correction also showed that the increase in knowledge in the intervention group was statistically significant ($p = 0.012$), whereas the control group did not show a significant difference ($p = 0.019$). These findings indicate that the POPAN 3D medium is capable of providing a greater increase in knowledge compared to the flipchart medium.

These findings are consistent with the Information Processing Theory proposed by Atkinson and Shiffrin, which explains that information received during the learning process passes through the stages of sensory memory, short-term memory, and long-term memory. Information that receives attention, is processed deeply, and is reinforced through

rehearsal is more easily stored in long-term memory and retrieved when needed. Therefore, learning media capable of enhancing students' attention, active engagement, and understanding will result in better knowledge retention. This is evident in the intervention group, which experienced a smaller decline in knowledge scores compared to the control group during the retention period, indicating that information acquired through the POPAN 3D medium is better retained in long-term memory. [24]

The use of QR code technology in educational media has been shown to increase student engagement and motivation to learn. In line with the research by Fitriana and Setyasto (2023), who developed a video-assisted, QR-code-based Ritatoon medium to improve the learning outcomes of elementary school students, the results showed that QR-code-based media can significantly improve students' cognitive understanding because it provides direct access to visual content that reinforces written material. [25]

The integration of digital technology (video/animation) into physical media has proven to be more effective than one-dimensional media. Research shows that the use of video media is significantly more effective at enhancing knowledge than flip charts because of its ability to present information in a more dynamic way and capture students' attention. [26–28] These findings are also supported by Azizah's (2022) study on the development of QR Code-assisted pop-up books, which demonstrated that the combination of pop-up books and QR Codes is both feasible and effective in improving student learning outcomes. [29]

• *Analysis of the Test of Differences in Attitude Scores Before and After the Intervention*

The results of the study showed that both the control group and the intervention group experienced an increase in attitude scores after receiving education on oral health care. This is indicated by the mean difference (Δ) in attitude scores, which was 11.40 ± 4.39 in the control group and 17.77 ± 3.92 in the intervention group. Post hoc test results with Bonferroni correction also showed that the changes in attitude scores in both groups were statistically significant ($p < 0.0167$). Nevertheless, the intervention group had a larger mean difference in change compared to the control group, indicating that education using the QR Code-Integrated Hybrid Pop-Up Book (POPAN 3D) was more effective in improving students' attitudes toward oral health maintenance.

The study results indicate that the use of the Hybrid Pop-Up Book Integrated with QR Codes (POPAN 3D) is more effective in improving students' attitudes toward oral health maintenance than the flipchart medium. This improvement is influenced by the presentation of material that combines three-dimensional visuals, interactive activities, and QR Code-based videos, thereby enhancing students' attention, interest, and engagement during the learning process. These findings are consistent with the Health Belief Model (HBM), which explains that increased knowledge about the benefits of maintaining dental health can foster positive attitudes toward health behaviors [30].

In addition, the combination of print and digital media provides a more engaging and meaningful learning experience. According to the Cognitive Theory of Multimedia Learning, presenting information through text, images, and video helps students understand the material while also influencing affective aspects, including attitude formation [31]. These findings are supported by a study by Sahara et al., which found that the simultaneous combination of various media elements is more effective in changing children's attitudes toward dental caries prevention than a single-method approach. [32]. The POPAN 3D media, featuring 3D animated content that visually illustrates the differences between healthy and unhealthy teeth, creates a stronger emotional impact than static images on a flipchart. This demonstrates that interactive media based on animation and QR codes are more effective in improving attitudes and learning motivation than conventional media. [27,33]

- *Analysis of the Test of Differences in Skill Scores Before and After the Intervention*

The results of the study showed that the intervention group, which received education using the POPAN 3D medium, experienced a greater improvement in oral health maintenance skills compared to the control group, which used flipcharts. This was indicated by the mean difference (Δ) in skill scores, which was 11.17 ± 3.23 for the intervention group—higher than the control group's score of 6.77 ± 2.79 . Post hoc tests with Bonferroni correction indicated that the improvement in skills in the intervention group was statistically significant ($p = 0.003$), whereas the control group did not show a significant difference ($p = 0.029$). These findings suggest that a meaningful change in skills occurred only in the group that received education using the POPAN 3D medium.

The improvement in skills in the intervention group is believed to be influenced by the characteristics of POPAN 3D, which integrates three-dimensional illustrations, interactive activities, and QR code-based animated videos. The step-by-step presentation of the material helped students understand, imitate, and practice proper toothbrushing techniques. These findings are consistent with skill development theory, which states that skill mastery begins through a process of observing, imitating, and repeated practice; thus, media that present procedures visually and systematically are more effective in improving students' skills [34].

This is consistent with the study by Siregar et al., which compared various media and found that media incorporating demonstrations (whether in person or via video) had a significantly greater impact on oral health maintenance skills than the use of leaflets alone [35].

The integration of technology into print media (POPAN 3D) allows students to observe toothbrushing techniques repeatedly through audio-visual demonstrations. Other studies have also confirmed that the use of video media and educational games is more effective in improving the oral hygiene index (Personal Hygiene Performance) than traditional educational methods. [26,36]

- *A Comparative Analysis of the Effectiveness of the Hybrid Educational Medium "Pop-Up Book with Integrated QR Code" (POPAN 3D) in the Intervention Group Compared to the Control Group*

The results of the study show that the POPAN 3D medium is more effective than the flipchart medium in improving students' knowledge, attitudes, and skills regarding oral health care. The intervention group showed an increase in knowledge ($\Delta = 9.63 \pm 0.65$ vs. 7.27 ± 2.54 ; $p = 0.008$), attitudes ($\Delta = 17.77 \pm 3.92$ vs. 11.40 ± 4.39 ; $p < 0.001$), and skills ($\Delta = 11.17 \pm 3.23$ vs. 6.77 ± 2.79 ; $p < 0.001$) compared to the control group.

The superiority of the POPAN 3D medium is supported by its characteristics, which integrate visual, audio, and interactive elements through three-dimensional pop-ups, educational stories, QR codes linked to videos, and educational games. This combination creates a more engaging, multisensory learning experience and increases student engagement, making information easier to understand, remember, and apply compared to the more static flipchart medium.

These findings align with Edgar Dale's Cone of Experience, which states that more concrete learning experiences involving various forms of media enhance learners' understanding. Additionally, Mayer's Cognitive Theory of Multimedia Learning explains that presenting information through a combination of text, images, audio, and animation enhances learning effectiveness by simultaneously engaging both visual and auditory channels. Thus, the characteristics of POPAN 3D media support more active, student-centered learning and contribute to more optimal improvements in knowledge, attitudes, and skills compared to flipchart media. [7,31]

This aligns with Kandiri's (2025) research, which states that QR Code technology allows learning materials to be presented in a more interactive and engaging manner, thereby increasing student engagement in the learning process. Through the integration of QR codes, students can access various digital learning resources that support a deeper understanding of the material. This aligns with the characteristics of 3D POPAN media, which integrates pop-up books, educational videos, and interactive activities into a single learning medium, thereby providing a more engaging learning experience compared to conventional media. [37,38].

V. CONCLUSION

The QR Code-Integrated Hybrid Pop-Up Book (POPAN 3D) educational medium has very high validity (0.95) and good reliability (0.85), making it suitable for use as an oral health education medium. The use of the POPAN 3D medium proved to be more effective than the flipchart medium in improving students' knowledge ($p = 0.008$), attitudes ($p < 0.000$), and oral health maintenance skills ($p < 0.000$). Thus, the POPAN 3D medium can be recommended as an innovative and effective educational medium to support promosi kesehatan gigi dan mulut pada siswa sekolah dasar.

REFERENCES

- [1]. Marla Kementerian Kesehatan Republik Indonesia. Survei Kesehatan Indonesia 2023. Jakarta: Badan Kebijakan Pembangunan Kesehatan; 2023. Tersedia Di: <https://Repository.Badankebijakan.Kemkes.Go.Id/>.
- [2]. Adiningrat A, Farani W. Support The Program Of Caries-Free Indonesia In 2030: Optimizing Oral Health Promotion At An Early Age. *Community Empower*. 2023;8(8):1251-1256. Doi:10.31603/Ce.9077
- [3]. Badan Penelitian Dan Pengembangan Kesehatan. Laporan Provinsi Sumatera Barat Riskesdas 2018. Jakarta: Lembaga Penerbit Badan Penelitian Dan Pengembangan Kesehatan; 2019.
- [4]. Rosenstock IM. The Health Belief Model And Preventive Health Behavior. *Health Educ Monogr*. 1974;2(4):354-386. Doi:10.1177/109019817400200405
- [5]. Ningrum N, Marah Laut D, Heriyanto Y. Pelatihan Pendidikan Kesehatan Gigi Pada Guru-Guru Dengan Memakai Media Video Tutorial Menyikat Gigi Di Madrasah Ibtidaiyah. *J Pengabd Masy Kesehat Indones*. 2022;1(1):40-44. Doi:10.34011/Jpmki.V1i1.970
- [6]. Kurniawati Dwi, Juwita Radiya Ningsih, Fiqi Faisal Kirom, Anindya Hanum Afna Hayaimpact Of School Dental Health Education Programme On Elementary School Students In Kartasura, Indonesia. *Journal Of International Dental And Medical Research* ISSN 1309-100X Dental Health Education [Http://Www.Jidmr.Com](http://Www.Jidmr.Com).
- [7]. Dale E. Audiovisual Methods In Teaching. 3d Ed. Dryden Press; 1969.
- [8]. Ramadhani H, Hayati NF, Amos J, Sidiq R, Lestari EML. Perubahan Pengetahuan Dan Sikap Remaja Tentang Pencegahan Obesitas Melalui Aplikasi Berbasis Android. *Ahmar Metastasis Health J*. 2023;3(2):87-96. Doi:10.53770/Amhj.V3i2.216
- [9]. Hatfield TG, Withers TM, Greaves CJ. Systematic Review Of The Effect Of Training Interventions On The Skills Of Health Professionals In Promoting Health Behaviour, With Meta-Analysis Of Subsequent Effects On Patient Health Behaviours. *BMC Health Serv Res*. 2020;20(1):593. Doi:10.1186/S12913-020-05420-1
- [10]. Masturoh I, Anggita N. Metodologi Penelitian Kesehatan. Badan Pengembangan Dan Pemberdayaan Sumber Daya Manusia Kesehatan; 2018. https://Repository.Dinus.Ac.Id/Docs/Ajar/Metodologi-Penelitian-Kesehatan_SC.Pdf
- [11]. Putu Sudayasa Dr I, Nani Yuniar Mk, Mahardika Ratih Resti Andani Mk, Rusmali Mk, Heri Djamiatul Maulana Mds. Pendidikan kesehatan dan ilmu perilaku. In: cv eureka media aksara [Internet]. Purbalingga; 2025 [Cited 2026 Jan 6]. Available From: <https://Repository.Penerbiteureka.Com/Media/Publications/593537-Pendidikan-Kesehatan-Dan-Ilmu-Perilaku-5db72696.Pdf> ISBN; 978-634-221-278-3.
- [12]. Hasrul N, Day AK, Baharuddin VI, Lenggany WF. Pengaruh Media Pop-Up Terhadap Peningkatan Pengetahuan Dan Kesehatan Gigi Dan Mulut Siswa-Siswi Di Sekolah Dasar No.19 Limboro, Majene. Published Online 2020.
- [13]. Rahmi SA, Mulia RJ, Sara F, Rahman WA. Penggunaan Media Yang Efektif Dalam Promosi Kesehatan Gigi Dan Mulut Pada Anak Sekolah Dasar. *JIKES: Jurnal Ilmu Kesehatan*. 2023;1(2):203-209. JIKES J Ilmu Kesehat. 2023;1(2):203-209. Doi:10.71456/Jik.V1i2.278
- [14]. Khair A, Pahrurrozi M, Purbaningrum E, Saputra AY. Development Of Android Application-Based Digital Literacy Media To Improve The Reading Ability Of ADHD Students. *J Inov Teknol Pendidik*. 2023;10(4):372-384. Doi:10.21831/Jitp.V10i4.63849
- [15]. Annisa Nabilah Mufidah, Eko Sri Wahyuni, Laili Fitri Yeni. The Feasibility Of Heyzine-Based E-Flipbook Media For Kingdom Monera Sub-Material. *BIOMA J Ilm Biol*. 2025;14(2):46-61. Doi:10.26877/207e2356
- [16]. Octafia D, Supriyadi S, Sulhadi S. Validity And Reliability Content Of Physics Problem Solving Test Instrument Based On Local Wisdom. *J Educ Res Eval*. 2021;9(1):46-51. Doi:10.15294/Jere.V9i1.43712
- [17]. Eko W, Afandi A, Wolly C. Kelayakan Film Dokumenter Pada Materi Jenis-Jenis Bahan Baku Pakan Kelas X SUPM Negeri Pontianak. *Bioma J Ilm Biol*. 2021;10(2):248-262. Doi:10.26877/Bioma.V10i2.7903
- [18]. Hotimah H, Muhtadi A. Pengembangan Multimedia Pembelajaran Interaktif IPA Untuk Meningkatkan Pemahaman Siswa Pada Materi Mikroorganisme SMP. *J Inov Teknol Pendidik*. 2018;4(2):201-213. Doi:10.21831/Jitp.V4i2.15047
- [19]. Hariyanto D, Prasetyo F. Penerapan Metode Unified Approach Pada Sistem Informasi Akademik Berbasis Website. 2019;(1).
- [20]. Fitria Afifah Husen, Fitria Wulandari. Pengaruh Media Game Edukasi Zep Quiz Terhadap Pemahaman Konsep IPA Siswa Di Sekolah Dasar Pada Materi Perubahan Wujud Benda. *J Pendidik MIPA*. 2025;15(3):940-947. Doi:10.37630/Jpm.V15i3.3051
- [21]. Kuntari S. Pemanfaatan Media Digital Dalam Pembelajaran. *Pros Semin Nas Fak Tarb Dan Ilmu Kegur IAIM Sinjai*. 2023;2:90-94. Doi:10.47435/Sentikjar.V2i0.1826
- [22]. Radityan FT, Kuntadi I, Komaro M. Pengaruh Multimedia Interaktif Terhadap Hasil Belajar Siswa Pada Kompetensi Perbaikan Differential. *J Mech Eng Educ*. 2016;1(2):239. Doi:10.17509/Jmee.V1i2.3807
- [23]. Gulo S, Harefa AO. Pengembangan Media Pembelajaran Interaktif Berbasis Powerpoint. *Educ J Pendidik*. 2022;1(1):291-299. Doi:10.56248/Educativo.V1i1.40
- [24]. Atkinson RC, Shiffrin RM. Human Memory: A Proposed System And Its Control Processes. In: *Psychology Of Learning And Motivation*. Vol 2. Elsevier; 1968:89-195. Doi:10.1016/S0079-7421(08)60422-3
- [25]. Fitriana SDA, Setyasto N. Pengembangan Ritatoon Berbasis Qr-Code Berbantuan Video Untuk Meningkatkan Hasil Belajar Ips Siswa Kelas V Sekolah Dasar. *Prima Magistra J Ilm Kependidikan*. 2023;4(3):415-427. Doi:10.37478/Jpm.V4i3.2939
- [26]. Kantohe ZR, Wowor VNS, Gunawan PN. Perbandingan Efektivitas Pendidikan Kesehatan Gigi Menggunakan Media Video Dan Flip Chart Terhadap Peningkatan Pengetahuan Kesehatan Gigi Dan Mulut Anak. *E-GIGI*. 2016;4(2). Doi:10.35790/Eg.4.2.2016.13490
- [27]. Melandani AP, Parengkuan WG, Wahyuni R. Perbandingan Efektivitas Media Permainan Monopoli

- Kesehatan Gigi Dan Video Edukasi Terhadap Pengetahuan Kesehatan Gigi Dan Mulut. E-Gigi. 2026;14(2):362-367. Doi:10.35790/Eg.V14i2.66069
- [28]. Maulida N, Syamsuyurnita S. Implementasi Media Pop Up Book Untuk Meningkatkan Motivasi Belajar Siswa Dalam Pengenalan Budaya Indonesia Di Sanggar Bimbingan Kampung Bharu Malaysia. J Pendidik Dan Pembelajaran Indones JPPI. 2025;5(2):880-888. Doi:10.53299/Jppi.V5i2.1412
- [29]. Idris I, Wahid AN, Kusuma TD, Nurfauzi M. Analisis Peran Dan Efektivitas Multimedia Dalam Transformasi Pembelajaran Modern.
- [30]. Jaya H, Syokumawena S, Kumalasari I, Rosnani R. Penerapan Teori Health Belief Model (Hbm) Dalam Perilaku Pencegahan Kanker Payudara Dengan Pemeriksaan Payudara Sendiri (Sadari). J Kedokt Dan Kesehat Publ Ilm Fak Kedokt Univ Sriwij. 2023;10(3):325-334. Doi:10.32539/JKK.V10I3.22149
- [31]. Idris I, Wahid AN, Kusuma TD, Nurfauzi M. Analisis Peran Dan Efektivitas Multimedia Dalam Transformasi Pembelajaran Modern.
- [32]. Sahara R, Putri SA, Tampubolon MM. Pengaruh Pendidikan Kesehatan Dengan Metode Mixed Media Education Intervention Program Terhadap Pengetahuan Dan Sikap Anak Sekolah Dasar Tentang Karies Gigi. Borneo Nurs J BNJ. 2026;8(1):2585-2597. Doi:10.61878/Bnj.V8i1.477
- [33]. 76. Nino Adib Chifdillah, Adinda Gusti Nurhaliza, Yona Palin, Dini Indo Virawati. Efektivitas Teka-Teki Silang Sebagai Media Pendidikan Kesehatan Tentang Kesehatan Gigi Dan Mulut Pada Siswa Sekolah Dasar Di Samarinda. Sehat Rakyat J Kesehat Masy. 2025;4(4):871-879. Doi:10.54259/Sehatrakyat.V4i4.5135
- [34]. Adventus M, Merta Jaya IM, Mahendra D. Buku Ajar Promosi Kesehatan. In: Buku Ajar Keperawatan [Internet]. Jakarta: Universitas Kristen Indonesia; 2019 [Cited 2026 Jan 6]. Available From: [Http://Repository.Uki.Ac.Id/2759/1/BUKUMODULPR.OMOSIKESEHATAN.Pdf](http://Repository.Uki.Ac.Id/2759/1/BUKUMODULPR.OMOSIKESEHATAN.Pdf).
- [35]. Siregar R, Nainggolan SJ, Dewi SB. Perbandingan Animasi, Leaflet, Dan Demonstrasi Terhadap Pengetahuan Dan Keterampilan Pemeliharaan Kesehatan Gigi: Comparison Of Animation, Leaflet, And Demonstration On Dental Care Knowledge And Skills. Gemakes J Pengabdian Kpd Masy. 2026;6(1):68-74. Doi:10.36082/Gemakes.V6i1.2882
- [36]. Sumardi DR, Riyanto A, Rahmiyati AL, Nugrahaeni DK, Suhat S. Efektivitas Media Video Dan Permainan Ular Tangga Terhadap Praktik Menyikat Gigi Dan Index PHP (Personal Hygiene Performance) Pada Siswa Di SDN Pondok Panjang Kabupaten Lebak Provinsi Banten. J Sos Teknol. 2025;5(4):1189-1203. Doi:10.59188/Jurnalsostech.V5i4.32140
- [37]. Kandiri K, Nurwahidin M, Aransyah A, Purmadi A. Development Of Qr-Code Media-Based Modules In Constructing Learning To Increase Learning Motivation. J Teknol Pendidik J Penelit Dan Pengemb Pembelajaran. 2025;10(1):191. Doi:10.33394/Jtp.V10i1.14577
- [38]. Ruswita AP, Hadisaputro S, Suwondo A. Development Of Smart Toothbrush (VIT-Brush) To Improve Toothbrushing Behavior Of Visually Impaired Children. Int J Adv Health Sci Technol. 2025;5(4):202-208. Doi:10.35882/Ijahst.V5i4.520