

**Research Article**

# The Effectiveness of Artificial Intelligence-Based Animated Video Education on Elementary School Students' Dental Health Knowledge

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## KEYWORDS

Education, dental health, knowledge, artificial intelligence, animated video.



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## ABSTRACT

**Introduction:** Oral health problems among children remain high due to limited knowledge and poor hygiene habits. The 2023 Indonesian Health Survey reported that 50.9% of the population experience oral health problems, while only 3.4% practice proper toothbrushing. Engaging educational media are therefore needed. Artificial intelligence (AI)-based animated videos provide interactive visual and audio content that is easily understood by children. This study evaluated their effectiveness in improving dental and oral health knowledge among elementary students.

**Materials and Methods:** This quasi-experimental study used a one-group pretest-posttest design involving 53 fourth-grade students of SDN 146/VIII Rejosari. Dental health education was delivered using AI animated video media. Knowledge was assessed using a 19-item questionnaire before and after the intervention and categorized into good, sufficient, and poor. Data were analyzed using a paired t-test ( $p < 0.05$ ).

**Results and Discussions:** Before the intervention, most students had poor knowledge (69.81%), followed by sufficient (26.42%) and good (3.77%). After education, the good category increased to 52.83%, sufficient decreased to 39.62%, and poor decreased to 7.55%. Paired t-test results showed a significant improvement ( $p < 0.001$ ).

**Conclusion:** AI animated videos effectively improve elementary students' dental and oral health knowledge.

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## INTRODUCTION

Dental and oral health problems among children remain a significant public health concern, particularly among elementary school-aged groups, and are closely associated with low levels of knowledge regarding oral hygiene as well as the lack of consistent dental care habits from an early age.<sup>1</sup> Elementary school children, especially those aged 9–10 years, require special attention because they are in a critical stage of behavioral and habit formation, where learning is more effective through concrete experiences and guidance.<sup>2</sup> Habits established during this period play an important role in determining dental and oral health status in later life, highlighting the importance of early preventive education.<sup>3</sup>

Data from the 2018 Basic Health Research of Jambi Province revealed that 52.08% of the population experienced dental and oral health problems, while only 0.98% practiced proper toothbrushing behavior.<sup>4</sup> Meanwhile, the 2023 Indonesian Health Survey (SKI) reported that 50.9% of the population in Jambi Province still experienced dental and oral health problems, although there was a slight increase in proper toothbrushing behavior to 3.4%.<sup>5</sup> These findings indicate that dental and oral health problems remain prevalent, and promotive–preventive efforts through oral health education for elementary school children must be continuously improved using more effective approaches that align with children’s learning characteristics.<sup>1</sup>

Dental and oral health knowledge among elementary school students is still relatively low; therefore, educational media that can attract attention, enhance understanding, and encourage active student engagement in the learning process are needed.<sup>6</sup> Dental health education delivered

through less engaging media may reduce children’s ability to absorb information.<sup>7</sup> The use of animated video media is considered effective because it presents information through a combination of moving visuals and audio, making it easier for children to understand and remember the material presented.<sup>8</sup>

Along with the rapid development of digital technology, artificial intelligence (AI)–based animated videos have emerged as an innovative educational tool that provides more interactive, engaging, and adaptive learning experiences.<sup>9</sup> AI technology enables the development of contextual, communicative, and age-appropriate animated content, which can enhance students’ attention, understanding, and retention of information.<sup>10</sup> In the context of learning, including health education, the use of animated video media has been shown to significantly improve students’ motivation, comprehension, and learning outcomes compared to conventional teaching methods.<sup>11</sup>

Various AI applications, such as ChatGPT, Gemini, and Perplexity, can assist in analyzing information and supporting the development of learning media, including engaging and easily understandable educational animated videos for elementary school students.<sup>12</sup> Multimodal generative AI can help educators design scripts, storylines, and visual concepts in a more structured manner, as well as produce high-quality video content through prompt-based features.<sup>13</sup> The utilization of AI-based animated videos is considered effective because it can simplify learning materials, enhance motivation, stimulate learning interest, and improve students’ comprehension. However, the use of AI still requires critical evaluation, as the

outputs depend on data and algorithms and may contain limitations or inaccuracies.<sup>14</sup>

Based on interviews with the local public health center, dental and oral health education at SDN 146/VIII Rejosari, Jambi, was last conducted approximately two years ago using conventional methods and has not utilized AI-based animated video media. Additionally, interviews with school-teachers indicated that there is no specific or routine program for dental and oral health education. Therefore, this study aims to determine the effect of artificial intelligence-based animated video education on students' dental health knowledge as an effort to support more effective and technology-relevant educational innovations.

## MATERIALS AND METHODS

This study employed a quasi-experimental design with a one-group pretest-posttest approach conducted among fourth-grade students at SDN 146/VIII Rejosari, Jambi, with a total sample of 53 respondents selected through random sampling. The educational material covered dental and oral health knowledge, including the correct timing of toothbrushing, the use of dental floss, the importance of routine dental visits, and the appropriate amount of toothpaste. The material was delivered through an artificial intelligence-based animated video after the respondents completed the pretest. The knowledge questionnaire consisted of 19 statements with true/false answer options, which were aligned with the educational content provided. A preliminary study was conducted among fourth-grade students at SDN 13/VIII Muara Kilis, Jambi, to assess the validity and reliability of the questionnaire. The results showed that all 19 items were valid ( $r\text{-count} > 0.361$ ) and reliable (Cronbach's  $\alpha = 0.919$ ). The

inclusion criteria were active students who had obtained informed consent from their parents or guardians and had not received dental and oral health education within the previous six months. The collected data were analyzed using a normality test followed by a paired t-test. The entire research protocol received ethical approval from the Health Research Ethics Committee (KEPK), Faculty of Dentistry, Universitas Trisakti, with approval number 952A/S1/KEPK/FGK/8/2025.

## RESULTS AND DISCUSSIONS

As shown in Table 1, most respondents were aged 9 years, totaling 38 students (71.70%), while 15 students (28.30%) were aged 10 years. Based on gender, 28 respondents (52.83%) were female and 25 respondents (47.17%) were male.

Table 1. Respondent Characteristics

Characteristics	n	%	Mean $\pm$ SD
Age			
9 years old	38	71.70	9.28 $\pm$ 0.45
10 years old	15	28.30	
Gender			
Female	28	52.83	
Male	25	47.17	

Based on Table 2, an improvement in students' knowledge was observed after receiving dental health education through AI-based animated video media. Almost all statements showed an increase in the percentage of correct responses. The greatest improvement was observed in item number 11 regarding the correct time for toothbrushing, which increased by 69.81%, from 30.19% to 100%. Knowledge related to the correct timing for dental floss use (item number 15) also improved, rising from 69.81% to 92.45%. Furthermore, the understanding of the importance of visiting a dentist every six months (item number 19) increased from 58.49% to 96.23%. In addition,

students' knowledge about the appropriate amount of toothpaste (item number 9), defined as a pea-sized amount, showed improvement from 41.51% to 64.15%.

Table 2. Distribution of knowledge before and after education using AI animated video

No	Statement	Before	After	Δ
1	Dentin is the outermost layer of the tooth	43.30	75.47	32.10
2	Enamel is the hardest part of the tooth	54.72	73.58	18.86
3	Brownish spots are early signs of caries	60.38	77.36	16.98
4	The ideal toothbrush head is rounded	52.83	79.25	26.42
5	The toothbrush size should match the jaw arch	66.04	86.79	20.75
6	Toothbrushes should not be shared	41.51	94.34	52.83
7	Toothbrushes should be replaced at least every 6 months	54.72	79.25	24.53
8	Toothpaste is not always necessary when brushing	47.17	81.13	39.62
9	Toothpaste should cover the entire length of the bristles	41.51	64.15	22.64
10	The minimum tooth-brushing duration is 1 minute	43.40	75.47	32.07
11	The correct time for toothbrushing	30.19	100.00	69.81
12	When brushing the inner surfaces, use circular motions	54.72	83.02	28.30
13	When brushing the chewing surfaces should use back-and-forth motions	50.94	79.25	28.31
14	The use of toothpicks is not recommended	50.94	73.58	22.64
15	The correct time to use dental floss	69.81	92.45	22.64
16	Drinking water reduces the risk of caries	33.96	50.94	16.98
17	Fruits help clean the teeth	64.15	86.79	22.64
18	Dental check-ups are not only necessary when experiencing pain	41.51	84.91	43.40
19	Dental check-ups should be performed at least once a year	58.49	96.23	37.74

Note: Values are presented as percentages (%).; Difference (Δ) indicates the increase in percentage after the intervention.

Before the educational intervention, most respondents had poor knowledge (69.81%), while only 3.77% were categorized as having good knowledge. After receiving education using the AI-based animated video, the proportion of respondents with good knowledge increased substantially to 52.83%, while the poor knowledge category decreased to 7.55%.

Table 3. Knowledge categories of respondents before and after AI animated video education

Category	Before	After	Δ
Good	3.77	52.83	49.06
Sufficient	26.42	39.62	13.2
Poor	69.81	7.55	62.26

Note: Values are presented as percentages (%).; Difference (Δ) indicates the increase in percentage after the intervention; Category Good (>75%), Sufficient (56-75%), Poor (<56%)

The respondents' age range was limited to 9–10 years. At this stage, children are in the early concrete operational phase, in which understanding largely depends on real-life examples and direct experiences.<sup>15</sup> The lack of appropriate and continuous exposure to dental and oral health education at this age may contribute to the low level of dental health knowledge observed among some respondents.<sup>16</sup> The distribution of respondents by gender was relatively balanced between males and females. These relatively homogeneous characteristics suggest that age and gender were not dominant factors influencing changes in dental health following the educational intervention.<sup>17</sup>

Before the educational intervention, the lowest percentage of correct responses was found in the item regarding the correct timing of toothbrushing, which was still categorized as poor. After receiving education through an AI-based animated video, all respondents improved to the good category, resulting in an increase of 69.81%. These findings are consistent with the study by

Sukarsih et al.<sup>18</sup>, which demonstrated an improvement in students' knowledge after education using animated video media.<sup>18</sup> Furthermore, Melati et al. stated that visual media can enhance students' understanding and learning interest.<sup>19</sup> Respondents' knowledge regarding the timing of dental floss use was already in the good category before the educational intervention and showed further improvement after the intervention, remaining within the good category. This increase indicates that dental health education was effective in strengthening respondents' understanding of the proper use of dental floss. This improvement indicates that dental health education was effective in enhancing respondents' understanding of proper flossing practices. In contrast, Almassri et al.<sup>20</sup> reported that only 14% of respondents had adequate knowledge and understanding of dental floss use, reflected in the low prevalence of routine flossing within the community. This low practice was associated with insufficient knowledge regarding flossing for maintaining oral hygiene.<sup>21</sup>

The statement regarding the prohibition of sharing toothbrushes showed an improvement in knowledge from a poor category before the educational intervention to a good category after receiving education through an animated video. This indicates that the media was effective in enhancing students' understanding of personal hygiene in dental care. This finding aligns with Jannah et al.<sup>22</sup> who reported that dental health education through animated videos improved elementary school students' knowledge of proper oral hygiene behaviors, including the importance of using personal toothbrushes to prevent bacterial transmission and oral diseases.<sup>23</sup> Respondents' knowledge regarding the importance of visiting the dentist every six months improved from a moderate

category before the educational intervention to a good category after the intervention. This indicates that the educational intervention was effective in enhancing students' understanding of the importance of routine dental visits as a preventive measure against oral health problems.<sup>24</sup> These findings are consistent with the study by Kirana et al., which reported that elementary school students experienced an improvement in knowledge regarding dental check-ups from a poor category to a good category.<sup>25</sup>

For the statement regarding the use of a pea-sized amount of toothpaste, the percentage of correct responses increased from the poor category before the educational intervention to the moderate category after the intervention. These findings are consistent with the study by Haloho et al.<sup>26</sup> as well as other studies showing that education using animated video media can significantly improve students' knowledge.<sup>26</sup> This similarity in findings indicates that animated videos are effective in conveying information about the correct amount of toothpaste through clear, engaging, and easily understandable visual presentations.<sup>27</sup> Before AI-based animated video education, most respondents were categorized as having poor dental and oral health knowledge. This condition indicates that students' basic understanding of dental and oral health was still inadequate, possibly due to limited exposure to information through both school learning and the surrounding environment.<sup>28</sup> Therefore, providing dental health education from an early school age is essential as a foundation for establishing good and sustainable oral hygiene behaviors.<sup>29</sup>

The results of education using AI-based animated videos demonstrated a significant improvement in respondents' knowledge. Before education, only 3.77% of respondents were categorized as

having good knowledge, which increased substantially to 52.83% after the intervention. This finding is consistent with Harapan et al, who reported improvements in students' knowledge categories after animated video-based education, indicating that video media have a strong appeal and can enhance students' focus and comprehension.<sup>29</sup> With the advancement of educational technology, digital learning media such as AI-based animated videos are considered increasingly effective. Kusparmanto et al.<sup>30</sup> stated that animated videos present material interactively through an engaging combination of audio and visual elements, enabling messages to be delivered more clearly and comprehensively.<sup>29</sup> This approach facilitates respondents' understanding of dental and oral health materials and supports optimal knowledge improvement.<sup>30</sup>

Education using AI-based animated videos showed a statistically significant improvement in knowledge, as demonstrated by the paired t-test results before and after the intervention. This finding is consistent with Tsaqif et al.<sup>31</sup>, who reported significant differences between pretest and posttest scores after caries prevention education using animated videos. These findings confirm that animated videos are effective in enhancing respondents' knowledge through engaging, interactive, and easily understandable learning materials.<sup>31</sup>

## CONCLUSIONS

Based on the findings of this study, artificial intelligence (AI)-based animated video media were proven to be effective in improving elementary school students' knowledge of dental and oral health.

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