Effect of Animated Video Education on Elementary School Students Knowledge, Attitudes, and Smoking Intentions

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ABSTRACT

Background: *Smoking behavior in school-age children is an urgent public health problem in Indonesia due to the high prevalence of first-time smokers and the lack of interesting and easy-to-understand health education for children. One of the widely used educational media is animated videos, which are considered effective in attracting attention, increasing understanding, and changing children's behavior related to the dangers of smoking. This study aimed to analyze the influence of animation video-based education on the knowledge, attitudes, and intentions of smoking among elementary school students in Batealit District.*
Method: *This quasi-experimental study used a pretest–posttest with a control group design. The study was conducted on 184 students in grades IV–VI, who were divided into an intervention group (receiving education through four animated videos) and a control group (without intervention). The research instrument is in the form of a questionnaire of knowledge, attitudes, and intentions, which have been tested for validity and reliability. Data analysis included Wilcoxon and Mann–Whitney tests, as well as the Linear Mixed Model to control confounding variables, such as pocket money.*
Result: *The results showed a significant improvement in knowledge, attitudes, and smoking intentions in the intervention group, by 13.56%, 7.02%, and 4.25%, respectively, after adjustment. The overall difference between the intervention and control groups was significant ($p < 0.05$). Education through animated videos is effective in increasing knowledge, attitudes, and negative intentions toward smoking in elementary school students. This method can be widely implemented as a strategy to prevent smoking from an early age.*

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INTRODUCTION

School-age children are a vulnerable group in an important developmental phase, both physically, cognitively, and socially. UNICEF defines children as individuals aged 0–18 years who require protection and support to grow optimally.(1) During elementary school age, children's cognitive and social development increases rapidly, making them susceptible to being influenced by their surrounding environment, including risky behaviors such as smoking.(2–4)

Smoking behavior among children and adolescents is becoming an increasingly concerning public health issue worldwide. Research shows that the use of e-cigarettes and conventional cigarettes among Indonesian teenagers has increased in recent years. In fact, the level of nicotine dependence in the young age group has begun to be detected in various health surveys in Indonesia. Inadequate health education also causes many adolescents to lack knowledge of the dangers of smoking. This finding is supported by the 2018 Basic Health Survey report, which shows high exposure to cigarette smoke in the home environment and a high prevalence of novice smokers in various provinces in Indonesia. Data from the Central Statistics Agency also show that in some regions, including Central Java, the percentage of adolescent smokers remains significant.(5–10)

Some of the factors that contribute to the smoking behavior of elementary school children include lack of knowledge, peer exposure, the influence of parents who smoke, and easy access to cigarettes. In addition, the promotion of tobacco products, including advertising, sponsorship, and media exposure, has a major impact on the formation of positive attitudes towards cigarettes among adolescents. Smoking habits among adolescent girls are showing an increasing trend in some areas. The Government of Indonesia has issued Government Regulation Number 28 of 2024 regarding tobacco

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consumption control; however, implementation in the field still faces various challenges.(11–15)

Health education plays an important role in reducing smoking behavior. Digital media, such as animated videos, are increasingly used because they are attractive, easy for children to understand, and can convey messages effectively through a combination of visual and audio that increases attention and understanding. Research shows that educational interventions through animation can improve knowledge, attitudes, and smoking prevention behaviors in children and adolescents.(16–21)

Preliminary studies show that most elementary school students have not received formal education about the dangers of smoking or exposure to animated videos as a learning medium. This condition emphasizes the need for educational interventions that are interesting and in accordance with children's development needs. Therefore, this study was conducted to assess the influence of education through animated videos on the knowledge, attitudes, and intentions of smoking among elementary school students in the Batealit District.

METHOD

This study used a quasi-experimental approach with a pretest–posttest with a control group design. This design was chosen to assess the influence of education through animated videos on the knowledge, attitudes, and intentions of smoking among elementary school students. The research received ethical approval from the Research Ethics Commission of Diponegoro University and was carried out on students in grades IV–VI in several elementary schools in the Batealit District in September.

The research population comprised 4th, 5th, and 6th grade students in the Batealit district. The sampling technique used in this study was carried out in two stages. The first stage was the selection of schools using purposive sampling techniques with the following criteria: elementary schools located in villages with the highest number of smoking cases and no prior smoking intervention in the elementary school. Furthermore, sampling was carried out using the total sampling technique to determine participants who met the inclusion criteria, namely, being willing to participate in the entire series of research activities and obtain approval from the homeroom teacher. A total of 184 students were recruited and divided into intervention and control groups.

The intervention group received education through four animated videos from the official accounts of the Ministry of Health and Directorate General of Early Childhood Education. From the Ministry of Health's account, 16 videos related to cigarettes were obtained, and three videos were selected that met the research criteria, while from the account of the Directorate General of Early Childhood Education, one video related to cigarettes was found and according to the criteria. The selection of the video was based on several criteria, namely, using an animation format suitable for elementary school students, lasting less than four minutes, explaining the content of harmful substances in cigarettes in simple language, including a call-to-action that invites children to stay away from cigarettes, and containing an explanation that cigarettes can cause various diseases. The video was played according to the intervention schedule, namely, on the first day until the fourteenth day. The control group did not receive any intervention.

The instrument used was a questionnaire that had been tested for validity and reliability. The questionnaire consisted of three main parts: knowledge, attitude, and intention. Knowledge scores were calculated based on true-false answers, while attitudes and intentions were measured using a Likert scale with numerical scores to facilitate the analysis process. Questionnaires were administered at the pretest stage before the intervention and post-test after the entire series of interventions was completed.

All data were checked for completeness, coded, and analyzed. Descriptive analysis was used to describe the respondent characteristics and research variable scores. The Wilcoxon test was used to examine the difference in pre- and post-test scores within each group, while the differences between the intervention and control groups were analyzed using the Mann–Whitney U test. Linear mixed model (LMM) analysis was used to control for confounding variables, such as pocket money. The results of the analysis are presented in the form of p-values and a comparison of score changes between groups.

RESULT AND DISCUSSION

Based on the homogeneity test results in Table 1, the basic characteristics between the control and intervention groups showed that most of the variables had a p> value of 0.05, which means that both groups had equal initial conditions. There were no significant differences in sex ($p = 0.455$), age ($p = 0.386$), class ($p = 0.939$), and smoking habits of family members ($p = 0.123$). Similarly, the dependent variables before the intervention, including knowledge ($p = 0.727$), attitude ($p = 0.891$), and intention ($p= 0.990$), showed no significant differences between the two groups.

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However, the pocket money variable showed a p-value of 0.007; therefore, it was used as a confounding variable. Overall, these findings suggest that most of the respondent characteristics and dependent variables before the intervention were homogenous.

Based on Table 2, the age range of the respondents in both groups was between 9 and 12 years. The mean age in the intervention and control groups was 10.4 and 10.27 years, respectively, with a p-value of 0.386. This shows that there was no statistically significant difference between the ages of the respondents in the two groups.

Meanwhile, the respondents' allowance ranged from IDR 5,000 to IDR 20,000 in both the groups. The average allowance in the intervention group was Rp10,066.7 and in the control group was Rp8,787.2, with the same mode of Rp10,000. The results of the statistical test showed a significant difference in allowance between the intervention and control groups (p = 0.007). Thus, the allowance variable needs to be considered as a potential confounding factor in the next analysis because of the initial imbalance between groups.

As shown in Table 3, the three variables, namely, knowledge, attitude, and intention, experienced a greater increase in the intervention group than in the control group. In knowledge, the intervention group's score increased from 8.35±1.671 to 10.56±0.912 (Δ = 2.21), while the control group only increased from 8.23±2.055 to 8.56±1.892 (Δ = 0.33). Regarding attitude, the intervention group increased from 63.12±8.541 to 71.87±5.233 (Δ = 8.75), while the control group increased slightly from 60.08±8.894 to 60.78±10.899 (Δ = 0.70). At intention, the intervention group's score increased from 82.10±11.529 to 92.50±6.933 (Δ = 10.40), while the control group only increased from 78.38±12.920 to 75.77±14.320 (Δ = 2.61). Overall, the intervention group showed greater improvement, indicating that education through animated videos was effective in increasing knowledge, forming positive attitudes toward rejecting smoking behaviors, and lowering students' intentions toward smoking compared to the control group.

Table 1. Homogeneity test before intervention

Variable	Control Group		Intervention Groups		P value
	f	%	f	%	
Gender					0.455
Man	46	48.9%	49	54.4	
Woman	48	51.1%	41	45.6	
Age					0.386
9 years	22	23.4%	16	17.8	
10 years	32	34.0%	34	37.8	
11 years	33	35.1%	28	31.1	
12 years	7	7.4%	12	13.3	
Class					0.939
Grade 4	32	34.0%	30	33.3	
Grade 5	25	26.6%	26	28.9	
Grade 6	37	39.4%	34	37.8	
Allowance/Pocket money					0.007
≤10.000	86	91.5%	70	77.8	
>10.000	8	8.5%	20	22.2	
Smoking Habits of Family Members					0.123
Smoke	76	80.9%	64	71.1	
No Smoking	18	19.1%	26	28.9	
Knowledge (Mean ± SD)	8.23±2.055		8.35±1.671		0.727
Attitude (Mean ± SD)	60.08±8.894		63.12±8.541		0.891
Intention (Mean ± SD)	78.38±12.920		82.10±11.529		0.990

Table 2. Descriptive statistics of continuous variables in the intervention and control groups

Variable	Intervention Groups				Control Group				P-value
	Min	Max	Mean	Mode	Min	Max	Mean	Mode	
Age	9	12	10,4	10	9	12	10.27	11	0.386
Allowance	5000	20000	10066.7	10000	5000	20000	8787.20	10000	0.007

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In the intervention group, the knowledge score increased from 8.35 in the pre-test to 10.56 in the post-test (Δ = 2.21). The Wilcoxon test showed a p-value of 0.000, indicating that the increase was statistically significant. These findings indicate that animated video interventions contribute significantly to improving student knowledge. This shows that the changes that occurred were not statistically significant; therefore, there was no significant increase in knowledge in the control group during the study period.

Meanwhile, in the attitude variable, there was an increase in the intervention group from 63.12 in the pre-test to 71.87 in the post-test (Δ = 8.75). The Wilcoxon test showed a p-value of 0.000, indicating a significant change. These findings show that animated videos are effective in promoting positive attitudes toward rejecting smoking behavior. In contrast, in the control group, the attitude score increased only slightly from 60.08 to 60.78 (Δ = 0.70), with a p-value of 0.758. This insignificant improvement indicated that there was no significant change in attitudes in the control group during the study period.

Meanwhile, in the intention variable, the Wilcoxon test showed that the intervention group experienced an increase in intention score from 82.1 to 92.5 (an increase of 10.4 points; p = 0.000), indicating a significant difference after the intervention. In contrast, the control group showed a decrease in score from 78.38 to 75.77 (difference –2.61 points; p > 0.05), indicating no meaningful change in intention during the study period. The results of the statistical tests are presented in Table 4.

Analysis with the unadjusted Linear Mixed Model (LMM) can be seen in Table 5, showing that the animated video had a significant effect on all three study variables. Regarding knowledge, the intervention improved the score by 1.208 (95% CI: 0.831–1.584; p = 0.000), equivalent to a 13.557% increase from the baseline average. In attitude, there was an increase of 4.523 (95% CI: 2.561–6.485; p = 0.000), or 7.08% from the baseline value. The intent variable also increased significantly, with a value of 3.528 (95% CI: 0.819–6.236; p = 0.011), which was 4.304% of the baseline average. Overall, these findings indicate that education through animated videos is effective in increasing knowledge, improving attitudes, and significantly reducing smoking intention

Meanwhile, in the Linear Mixed Model (LMM) test, adjusted was used to assess the effect of the intervention after controlling for confounding variables in the form of pocket money. These variables were adjusted in the model to ensure that the observed changes truly reflected the influence of education through animated videos. After adjustment, the intervention still had a significant effect on all variables. For knowledge, a change of 1.208 (95% CI: 0.831–1.584; p = 0.000) was obtained, which was equivalent to a 13.56% increase from the baseline average. Regarding attitude, the intervention improved by 4.529 (95% CI: 2.588–6.470; p = 0.000), or 7.02% of the baseline values. Meanwhile, intent increased by 3.536 (95% CI: 0.887–6.184; p = 0.009), or 4.25% of the baseline average, after the intervention. Although the proportion of the increase is relatively slight compared to the unadjusted model, it is likely due to the change in the baseline mean after effect directional control. These results confirm that the animated video intervention had a significant influence on improving students' knowledge, attitudes, and intentions after controlling for confounding variables. The results are presented in Table 5

Table 3. Pretest posttest results in the control and intervention groups

Variabel	Intervention Groups				Control Group			
	Min	Max	Mean±SD	Mean±SD	Min	Max	Mean±SD	Mean±SD
Knowledge								
Pre-test	4	11	8.35±1.671	2.210±0.759	3	11	8.23±2.055	0.33±0.163
Post Test	6	11	10.56±0.912		3	11	8.56±1.892	
Attitude								
Pre-test	38	76	63.12±8.541	8.75±3.308	43	76	60.08±8.894	0.7±2.005
Post Test	52	76	71.87±5.233		35	76	60.78±10.899	
Intention								
Pre-test	52	96	82.1±11.529	10.4±4.596	37	96	78.38±12.920	2.61±1.4
Post Test	65	96	92.5±6.933		36	96	75.77±14.320	

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Table 4. Pre-test and post-test difference test of the intervention group and control group

Variable	*Mean* Intervention Group	P-value	*Mean* Control Group	P-value
Knowledge				
Pre Test	8.35	0.000	8.23	0.310
Post test	10.56		8.56	
Pretest - Posttest	2.21		0.33	
Attitude				
Pre Test	63.12	0.000	60.08	0.758
Post test	71.87		60.78	
Pretest - Posttest	8.75		0.70	
Intention				
Pre Test	82.1	0.000	78.38	0.251
Post test	92.5		75.77	
Pretest - Posttest	10.4		2.61	

Table 5. Effect of intervention on unadjusted knowledge scores, attitudes and intention

Grand Mean Score	Overall Mean at Baseline (Grand Mean)	Intervention effects (Unadjusted)			Overall Mean at Baseline (Grand Mean)	Intervention effects (Adjusted)		
		Absolute Magnitude (95% CI)	P-value	As % of Baseline Mean		Absolute Magnitude (95% CI)	P-value	As % of Baseline Mean
Knowledge	8.910	1.208 (0.831-1.584)	0.000	13.55	8.910	1.208 (0.831-1.584)	0.000	13.557
Attitude	63.879	4.523 (2.561-6.485)	0.000	7.08	64.491	4.529 (2.588-6.470)	0.000	7.022
Intention	81.961	3.528 (0.819-6.236)	0.011	4.30	83.179	3.536 (0.887-6.184)	0.009	4.251

The pretest results showed that both groups had equal knowledge, attitudes, and intentions. However, after the intervention, the Mann–Whitney U test showed a significant difference, with a much greater increase in scores in the group that received the animated video. This confirms that animated videos are effective in increasing knowledge, forming attitudes, and reducing smoking intentions, as only the intervention group was exposed to the material and learning process. The results of this study are consistent with those of Ashwini et al. (2023), who reported that education on the dangers of smoking significantly improved children's knowledge and attitudes compared with the non-intervention group.(22)

Knowledge is formed through the learning process when individuals receive and process information. Animated videos are an effective educational medium because they combine visuals, audio, and motion, making the message more interesting and easy to understand, especially for elementary school students. In health education, animated videos help explain abstract concepts more concretely and improve children's understanding of healthy living behaviors, including the dangers of smoking.(23–25) The results showed a significant increase in knowledge in the intervention group based on the Wilcoxon test (p=0.000), while the control group showed no significant change (p=0.310). Linear mixed Models (LMM) analysis also confirmed that the animation video intervention had a significant influence on knowledge improvement by 13.557%, even after adjusting for the confounding variable of the allowance. The intervention was carried out through the screening of educational videos containing material on the dangers of cigarette smoke, the mechanism of organ damage, and the long-term effects of smoking, and a positive response was obtained in the form of enthusiasm and active involvement of students.

These findings are consistent with previous research, such as Dharma (2023), who reported a significant increase in knowledge after an animated video intervention, and a study by Anjelika et al. (2025), who showed that the combination of educational videos and leaflets increased knowledge by 15.93%. Overall, the evidence confirms that animated videos are an effective educational medium for increasing the knowledge of elementary school students about the dangers of smoking because they can present information in an interesting, easy-to-understand, and

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appropriate manner for children's cognitive development stages.(26)(27)

Attitudes are internal responses formed through cognitive, affective, and conative processes and developed through experience, information, and social learning. In health promotion, educational media such as animated videos can be an effective stimulus to shape and change attitudes because they combine visual, audio, and movement elements that can increase the attention, understanding, and emotional involvement of the target.(28)(29)

The Wilcoxon test showed a significant improvement in attitudes in the intervention group (p=0.000), while the control group showed no significant change (p=0.758). The linear mixed model analysis corroborated the findings, where the animation video intervention had a positive effect on attitude change of 7.08% in the unadjusted analysis and remained stable at 7.022% after adjusting for confounding variables. The stability suggests that the effects of the intervention remained strong, even though they were controlled by other factors.

An increase in attitude of 7.022% indicates an important change in the way students interpret smoking behavior, especially after understanding the dangers of cigarettes for passive smokers. Students who previously considered smoking to be normal began to reject exposure to cigarette smoke and prioritized a smoke-free environment, indicating the formation of a stronger preventive attitude.

These findings are in line with previous studies that have shown that animated videos are effective in influencing attitudes through engaging visual and auditory stimulation. The Prahayu study (2024) proves that there is an increase in handwashing attitudes through the use of animated videos, while other studies show that audiovisual approaches that contain emotional aspects, such as the impact of passive smoking on the family, can produce stronger changes in attitudes than the delivery of cognitive information alone. Dual media, such as a combination of videos and leaflets, have also been shown to significantly improve attitudes. Thus, animated video media is an effective educational strategy for forming a positive attitude towards smoking prevention, especially when accompanied by an empathetic approach and context relevant to students' lives.(30)(31)

Intention is an internal tendency to perform a behavior that is formed through a rational consideration process of benefits and risks and is influenced by attitudes, subjective norms, and perceptions of self-control. In health promotion, intentions can be increased through education that is interesting and easy to comprehend. Animated videos are an effective medium because they can convey health messages visually, increase attention, and help children understand the consequences of a behavior, thus affecting beliefs, social impulses, and the perception of self-ability that underlie the formation of intentions.(32)

The Wilcoxon test showed a significant increase in intention in the intervention group (p=0.000), while the control group did not experience significant changes (p=0.251). Linear mixed model analysis also showed that the animated video intervention had an effect on a 4.304% decrease in smoking intention in the unadjusted analysis, and remained stable at 4.251% after adjusting for the confounding variable, indicating the consistency of the intervention effect. Thus, animated videos have been shown to be effective in reducing smoking intentions among elementary school students.

These findings are in line with the research of Lee et al. (2024), which shows that digital interventions based on interactive multimedia and educational games have a greater influence on the prevention of smoking intentions and behaviors when combined with interactive elements, repetition of messages, and exercise of smoking abstinence skills. Therefore, video-based learning will be more effective in fostering the intention to not smoke if it is equipped with an interactive and reflective approach.(33)

CONCLUSION

This study shows that education through animated videos is effective in increasing knowledge, forming negative attitudes towards smoking behavior, and reducing smoking intentions in elementary school students. Although some of the respondents' characteristics were not completely homogeneous, the results of the analysis that had been adjusted through the Linear Mixed Model still showed a consistent and significant direction of effect on all the main variables. These findings underline that animated video media is a relevant and interesting educational approach to encourage the prevention of smoking behavior from an early age.

The practical implications of this study emphasize the need for educational video playback to be integrated into routine school activities, such as morning literacy, at a frequency of once per week to reinforce health messages. Health promotion workers need to develop educational media that is interesting and appropriate to the characteristics of elementary school children, such as animated videos with simple language, relevant characters, and strong moral messages about the dangers of smoking, to support health promotion activities in schools. Parental support through the implementation of a smoke-free home

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environment and strengthening educational messages also plays an important role in maintaining the impact of interventions. To broaden the generalization of the findings, further research is recommended to use longer intervention durations, include a follow-up stage to assess the sustainability of the effects, and be conducted in areas with different sociocultural characteristics.

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Conflict of Interest

The authors stated that there was no conflict of interest in this study.

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