




Original Research

COVID-19 prevention education using interactive comic and animated videos on the health literacy of school-aged children: Implications for healthcare policy and management

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Abstract

Background: Amidst the COVID-19 pandemic, the proliferation of fake news and an infodemic has highlighted the necessity to enhance health literacy, particularly among school-aged children in the concrete operational phase of cognitive development. However, current health literacy studies predominantly focus on the adult population and overlook COVID-19 prevention protocols.

Objective: This study aimed to evaluate the effectiveness of COVID-19 prevention education utilizing interactive comic and animated videos on the health literacy of school-aged children in Sleman Regency, Yogyakarta, Indonesia.

Methods: The study employed a quasi-experimental research design with pretest-posttest nonequivalent control groups conducted from July to November 2021. Non-random sampling was utilized to select elementary schools and students, resulting in seventy-eight respondents. Health literacy was assessed using the modified 22-item Indonesian version of the Health Literacy Scale of COVID-19. Data analysis employed the Wilcoxon test.

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Article info

Received: 21 September 2022 | Revised: 24 February 2024 | Accepted: 5 May 2024

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Results: Significant improvements in children's health literacy were evident within the intervention group from pretest to posttest ($p = 0.046$, $p < 0.05$). Conversely, no significant change was observed within the control group post-intervention. Furthermore, comparable pre-intervention health literacy levels were noted across both groups, with a modest increase post-intervention, suggesting the intervention's potential to enhance health literacy, albeit to a limited extent.

Conclusion: The research highlights the significance of focused health education for school children, particularly in preventing COVID-19. Incorporating interactive media such as animated videos and comics in school programs can improve health literacy. Policymakers need to invest in creating and sharing engaging health education materials working with schools, communities, and parents. Moreover, integrating artificial intelligence-driven personalized learning platforms may be possible to enhance information delivery, enabling children to confidently address health issues in the digital era. These findings may also guide post-pandemic health education approaches, ensuring children are informed and ready for future health challenges.

Keywords

COVID-19; students; children; health literacy, health education; Indonesia; parents; interactive comic; animated videos

Background

The Coronavirus Disease 2019 (COVID-19) has spread to almost all parts of the globe, including Indonesia. Throughout this pandemic, fake news has circulated, particularly through conventional means such as TV, radio, and social media ([Indonesian Ministry of Women's Empowerment and Child Protection, 2020](#)). Challenges associated with the widespread dissemination of both accurate and inaccurate information (an "information epidemic") via the Internet or other communication channels have underlined the necessity of enhancing health literacy among children to cope with this situation ([Okan et al., 2020](#)).

During this pandemic, health literacy primarily focuses on three COVID-19 prevention protocols: wearing masks, maintaining distance and avoiding crowds, and washing hands with soap, along with vaccinations ([Committee for Handling COVID-19 and National Economic Recovery, 2021](#)). Initiatives to enhance health literacy are most impactful when initiated early, especially during childhood ([Fleary et al., 2018](#)). This developmental stage is crucial for cognitive, physical, and emotional growth and future health and well-being ([Abedian Kasgari et al., 2020](#); [Bröder et al., 2017](#)).

Research by [Okan et al. \(2020\)](#) on health literacy in the context of the COVID-19 pandemic indicates that although overall health literacy levels are high, a significant number of respondents reported difficulties in dealing with the coronavirus and responding to COVID-19 information. A staggering 47.8% of respondents experience difficulty in assessing the trustworthiness of media information about COVID-19. Confusion regarding coronavirus information is notably higher among those with lower levels of health literacy. A study by [Supriyati et al. \(2021\)](#) concerning health literacy and adherence to COVID-19 prevention protocols in students revealed that, generally, students have low adherence to health protocols due to a lack of awareness, with physical distancing being the most challenging protocol to follow.

Children's health literacy levels are influenced by their parents and the environment. They gain knowledge and skills related to health literacy through both formal and informal social support and peer assistance ([Bröder et al., 2017](#)). Education is crucial in shaping health literacy and can be delivered through various suitable media, including animated videos and comics ([Vamos et al., 2020](#)). Animated videos can effectively overcome cultural, age, time, and literacy barriers, while comics serve as graphic media that facilitate student learning ([Kayler et al., 2020](#); [Noviana et al., 2019](#)).

Although numerous studies have explored health literacy in the adult population, only a few have focused on children ([Fretian et al., 2020](#); [Vamos et al., 2020](#)). Moreover, previous research on COVID-19 health literacy has largely overlooked protocols for preventing COVID-19 in children. Based on the above rationale, the present study aims to assess the effectiveness of providing COVID-19 prevention education to school-aged children in Sleman Regency, Yogyakarta, utilizing interactive comics and animated videos to enhance their health literacy.

Methods

Study Design

This study employed a quasi-experimental research design with a pretest-posttest nonequivalent control group. Participants were divided into intervention and control groups. The independent variable was education on COVID-19 prevention using interactive comics and animated videos, while the dependent variable was the health literacy of school-aged children. External variables included children's age, sex, mother's education, parents' economic status, mother's occupation, and exposure to COVID-19 information sources.

Samples/Participants

The population for this study comprised all elementary school-aged children (8–11 years old) from Sleman Regency, Yogyakarta. Non-random sampling was utilized to select both the elementary schools and the students. Students were chosen based on the following inclusion criteria: 1) participation in all phases of the research, including pretest, health education, and posttest; 2) proficiency in reading and writing, with access to gadgets through parents or themselves; and 3) willingness to participate as research respondents. Meanwhile, exclusion criteria included children with mental disorders and chronic pain. The final cohort comprised 78 respondents, 40 in the intervention group and 38 in the control group.

Instruments

The Indonesian version of the Health Literacy Scale for COVID-19, comprising 22 items (HLS-COVID-Q22), was modified and employed in this study. The questionnaire comprised 31 questions, utilizing a 4-point scale: 1 = very difficult, 2 = difficult, 3 = easy, and 4 = very easy. The average score for HLS-COVID-Q22 was computed based on respondents' answers, ranging from 1 to 4. Health literacy levels were categorized into three based on the average score: ≤ 2.5 (inadequate health literacy), >2.5 to <3 (problematic health literacy), and ≥ 3 (sufficient health literacy) (Okan et al., 2020). The HLS-COVID-Q22 questionnaire included four dimensions: access with eight items, understanding with eight items, assessing with eight items, and applying with seven items.

Content and construct validity were assessed to evaluate the instrument's validity. Content validity was determined by eight experts, resulting in a Content Validity Index (CVI). The CVI indicated that the questions were valid, with a minimum value of 0.83 (Yusoff, 2019). Additionally, the CVI indicated the representation of each item in the children's health literacy questionnaire for school-aged children, with a Mean I-CVI value of 0.98. Construct validity was examined by 30 respondents from selected elementary schools in July 2021. Test results on the 32 questions in the questionnaire revealed that 31 questions were valid, with r -value ranging from 0.365 to 0.770. One question was excluded due to an r -value <0.365 . Consequently, a total of 31 questions were used in the questionnaire. The reliability test demonstrated a Cronbach alpha value of 0.956, indicating the high reliability of the health literacy questionnaire.

Intervention

The pre-test was administered to respondents who met the inclusion criteria. The following week, researchers provided education to the intervention group

through animated videos, and the respondents were given an interactive comic on COVID-19 prevention (see [Figure 1](#)). The video lasted approximately 12 minutes, followed by a 15-minute discussion. After this activity, respondents were briefed on using the interactive comic, which they could take home and read independently for one week. They were also instructed to complete the quiz accompanying the comic. The post-test was conducted one week after the children received health education through the interactive comic and animated videos. Links to the videos are available in [Figure 2](#) and [Figure 3](#).



Figure 1 Cover of the comic of COVID-19 transmission prevention

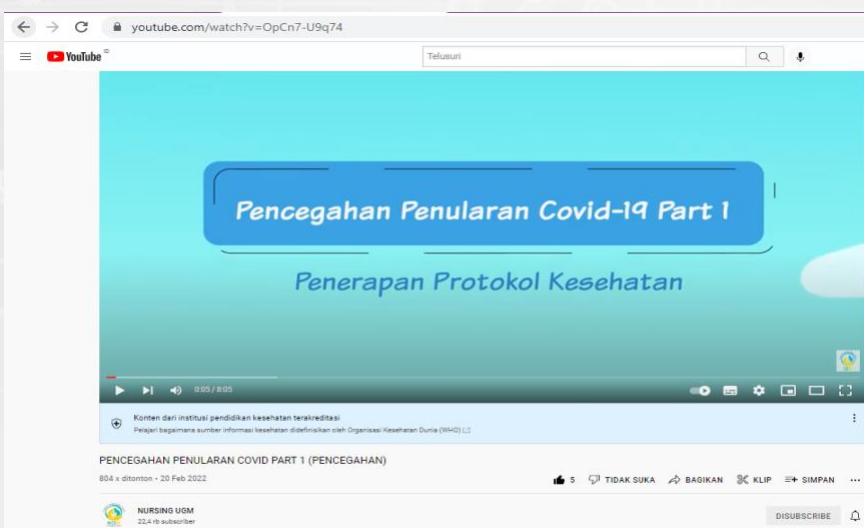


Figure 2 Screenshot of the animated video of COVID-19 transmission prevention Part 1

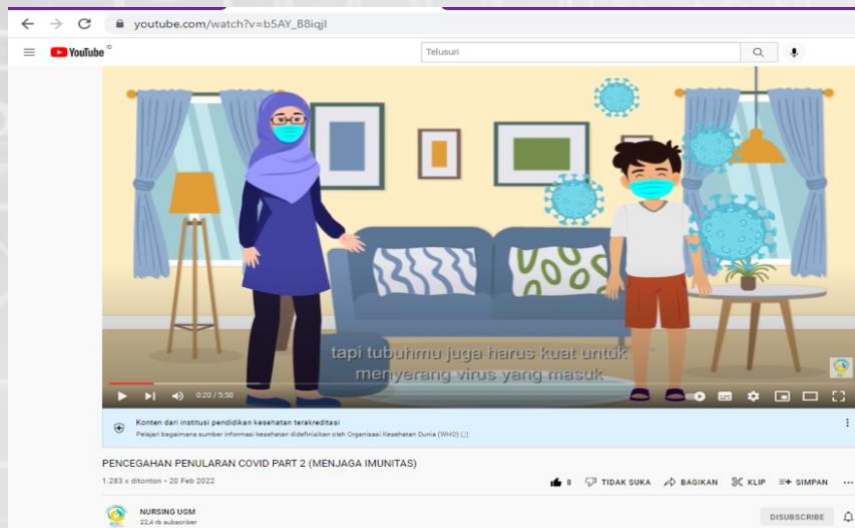


Figure 3 Screenshot of the animated video of COVID-19 transmission prevention Part 2

In the control group, initially, a pre-test was conducted on the research respondents. One week later, health education using animated videos (approximately 12 minutes) was provided, followed by a discussion lasting about 15 minutes. Post-tests with animated videos were administered one week after the intervention. Following the post-test, respondents were given interactive comics to take home. The research flow is depicted in Figure 4.

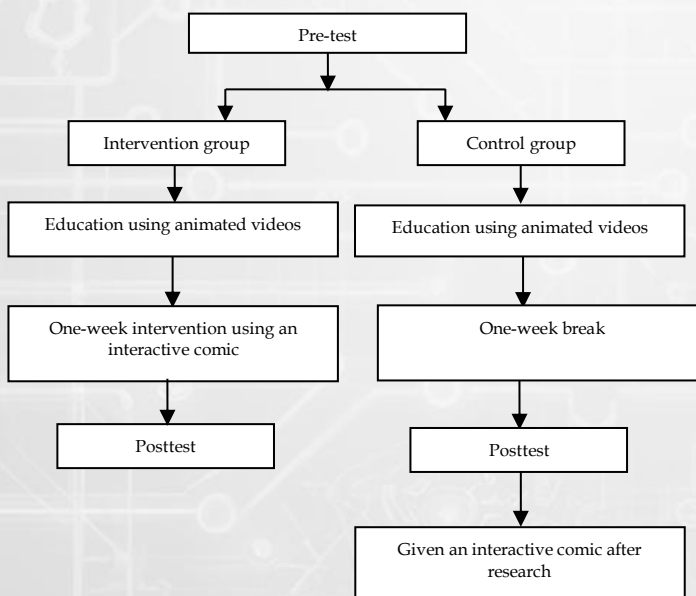


Figure 4 Intervention flow

Data Collection

This research was conducted from July to November 2021. Screening sheets were distributed, and respondents who met the inclusion and exclusion criteria were invited to join a WhatsApp group. The data collection process started after obtaining consent from the respondents. In the initial phase, both intervention

and control groups underwent a pre-test. The intervention, consisting of interactive comics and animated videos, was administered, followed by a post-test.

Data Analysis

A homogeneity test was conducted to ascertain similarities in the characteristics of the respondents in the two groups. Bivariate analysis was performed to assess the effectiveness of COVID-19 prevention education using interactive comics and animated videos on the health literacy of school-aged children by comparing the two groups. The Wilcoxon test was employed to elucidate the effectiveness of interactive comics and animated videos on children's health literacy.

Ethical Considerations

This research was approved by the Ethics Committee of the Faculty of Medicine, Public Health and Nursing, Universitas Gadjah Mada, with approval number KE/FK/0423/EC/2021.

Results

This study included 78 respondents with an average age ranging from nine to less than ten years. As indicated in [Table 1](#), the majority of respondents in both the intervention and control groups were female (52.5% and 52.6%, respectively). Concerning their mothers, most were in late adulthood (72.5% and 63.2% in the intervention and control groups, respectively), had predominantly attained secondary-level education (72.5% and 68.4% in the intervention and control groups, respectively), and were primarily housewives (65% and 71.1% in the intervention and control groups, respectively). The majority of respondents' parents earned less than the minimum wage (72.5% and 71.1% in the intervention and control groups, respectively), had 1–2 children (75% and 63.2% in the intervention and control groups, respectively), and did not have other family members residing with them (47.5% and 28.9% in the intervention and control groups, respectively). All respondents received information about COVID-19 (100% and 94.7% in the intervention and control groups, respectively), used gadgets for less than 1 hour (42.5% and 50% in the intervention and control groups, respectively), easily accessed the internet (87.5% and 89.5% in the intervention and control groups, respectively), and had family members who had been exposed to COVID-19 (30% and 34.2% in the intervention and control groups, respectively). The children's health literacy (pretest) was deemed sufficient (65% and 44.7% in the intervention and control groups, respectively).

Table 1 Characteristics of the respondents

		Group				p
		Intervention		Control		
		n = 40	%	n = 38	%	
Children's age	8-<9 years old	0	0.0	8	21.1	0.782
	9-<10 years old	40	100.0	21	55.3	
	10-<11 years old	0	0.0	8	21.1	
	≤11 years old	0	0.0	1	2.6	
Children's sex	Man	19	47.5	18	47.4	0.991
	Woman	21	52.5	20	52.6	
Mother's age	26-35 years old	11	27.5	13	34.2	0.653
	36-45 years old	29	72.5	24	63.2	
	46-55 years old	0	0.0	1	2.6	
Mother's education	Low	1	2.5	4	10.5	0.348
	Intermediate	29	72.5	26	68.4	
	High	10	25.0	8	21.1	
Mother's occupation	Work	14	35.0	11	28.9	0.567
	Housewife	26	65.0	27	71.1	
Parent's income	< Minimum Wage	29	72.5	27	71.1	0.887
	> Minimum Wage	11	27.5	11	28.9	
Number of children	1-2 children	30	75.0	24	63.2	0.257
	>2 children	10	25.0	14	36.8	
Number of other family members	0	19	47.5	11	28.9	0.130
	1-2 persons	15	37.5	15	39.5	
	>2 persons	6	15.0	12	31.6	
Duration of gadget uses	<1 hour	17	42.5	19	50.0	0.793
	1-2 hours	14	35.0	12	31.6	
	>2 hours	9	22.5	7	18.4	
Ease of internet access	Yes	35	87.5	34	89.5	1.000
	No	5	12.5	4	10.5	
Family record of COVID-19 infection	Yes	12	30.0	13	34.2	0.690
	No	28	70.0	25	65.8	
Pretest children's health literacy	Inadequate	1	2.5	1	2.6	0.084
	Problematic	13	32.5	20	52.6	
	Sufficient	26	65.0	17	44.7	

Table 2 highlights the differences in children's health literacy in the intervention group between the pretest and posttest, with a *p*-value of 0.046 (*p* < 0.05). Table 3 indicates that in the control group, children had no difference in health literacy before and after receiving health education.

As presented in Table 4, the children's health literacy before receiving health education (pretest) had a *p*-value of 0.084 in both groups. After the intervention, the children's health literacy had a *p*-value of 0.071. The Cohen (*d*) value was 0.315, indicating a clinically moderate effect size. This finding suggests a lack of difference in children's health literacy before and after the health education intervention for both groups. However, after receiving health education, sufficient health literacy increased compared to before the education was provided.

Table 2 Children’s health literacy before and after receiving health education in the intervention group analyzed using the Wilcoxon test (N = 40)

Group	Literacy	Pretest		Posttest		p Pre vs. Post
		n	%	n	%	
Intervention	Inadequate	1	2.5	0	0.0	0.046
	Problematic	13	32.5	7	17.5	
	Sufficient	26	65.0	33	82.5	

Table 3 Children’s health literacy before and after receiving health education in the control group analyzed using the Wilcoxon test (N = 38)

Group	Literacy	Pretest		Posttest		p Pre vs. Post
		n	%	n	%	
Control	Inadequate	1	2.6	3	7.9	0.109
	Problematic	20	52.6	10	26.3	
	Sufficient	17	44.7	25	65.8	

Table 4 Differences in children’s health literacy after health education intervention analyzed using Mann Whitney

	Group	Group				p	d
		Intervention		Control			
		n = 40	%	n = 38	%		
Posttest children’s health literacy	Inadequate	0	0.0	3	7.9	0.071	0.315
	Problematic	7	17.5	10	26.3		
	Sufficient	33	82.5	25	65.8		

Discussion

Education on COVID-19 prevention through interactive comics and animated videos significantly enhanced children’s health literacy before and after the intervention. The use of animated videos and interactive comics effectively captured the respondents’ attention. Children are particularly drawn to audio-visual media, especially animated videos, due to their engaging nature and use of simple language that is easily understandable for children. Audio-visual media can present information tangibly or realistically, enhancing understanding compared to purely auditory or visual media (Prawesti et al., 2018). Additionally, providing comic-form educational content helps capture children’s interest, as their enthusiasm for reading remains limited in Indonesia (Wahyuni, 2009). Comics serve as graphic media that facilitate student learning (Noviana et al., 2019), and they have been widely employed to promote health and encourage children to adopt healthy lifestyle choices (Tarver et al., 2016). According to Prawesti et al. (2018), integrating audio and visual media can offer effective learning stimuli, facilitating the absorption of substantial information.

This study yielded insignificant results in providing health education to the control group from the pretest to the posttest. While most of the respondents experienced increased health literacy levels, the results were not statistically significant. This outcome may have been influenced by the time gap between the

education delivery and the posttest, which was one week. The posttest was conducted one week after the intervention to assess long-term retention. The study revealed that health literacy regarding COVID-19 among respondents was not optimal for long-term retention. Materials for health education provided more than a week ago should be revisited or reviewed to ensure sustained knowledge retention (Bell et al., 2008).

This study also revealed a lack of difference in children's health literacy between the intervention and control groups before and after the health education intervention. Prior to receiving health education, each group had one child with inadequate health literacy. Both groups were educated using animated videos. Animated videos are effective in health education because they are engaging, artistic, easy to understand, informative, and efficient (Bell et al., 2008). Wulandari (2019) indicated that animated videos used in science learning for fourth-grade elementary school students in Jatilawang, Indonesia, effectively enhanced their learning outcomes. This finding suggests that animated videos effectively improve children's health literacy.

Overall, the majority of children in both groups had sufficient health literacy after the intervention. This finding indicates that children demonstrate a solid understanding of COVID-19 prevention following health education. Children are capable of accessing information about COVID-19, particularly on preventive measures and immune system maintenance. This result is corroborated by Bray et al. (2021), who investigated health literacy in children aged 7–12 years across various countries, including England, Sweden, Australia, Canada, Brazil, and Spain, revealing that children are aware of the severity and contagiousness of COVID-19 and possess the ability to gather necessary information about the virus.

The analysis indicated that the characteristics of the research subjects divided into the two groups were balanced (homogeneous). The age of the respondents corresponds to the target criteria of the research subjects, elementary school-aged children aged 8–11 years. According to Jean Piaget, this age range is in the phase of concrete operational cognitive development and is a critical stage for developing health literacy skills because children begin to form a framework for healthy actions for themselves (Bhagat et al., 2018; Bröder et al., 2017; Novieastari et al., 2019). Thus, children's health literacy development at this age is better than at other stages (Bhagat et al., 2018).

More females than males participated in this study. Research by Junus et al. (2020) on 5th-grade elementary school students showed that girls' reading ability assessed using print and digital media is higher than that of boys. Additionally, culture and parental role can also influence children's reading ability, specifically the time parents spend conversing with their children (Junus et al., 2020).

Most of the mothers in both groups were in late adulthood, and the majority of the parents were housewives. Working mothers assist their children, wait for them to learn, and help select learning media. Meanwhile, mothers at home (housewives) teach and reinforce subject matter at home, read storybooks, and balance learning materials between home and school (Sari & Ruhaena, 2017).

The majority of the mothers' highest education attainment in both groups was secondary or high school education. Mother's education levels can be linked to their knowledge. When people attain higher education, they can easily receive information and increase their knowledge (Waqidil & Adini, 2016). The income of parents in both groups was almost the same, with the majority earning less than the minimum wage. Regarding the number of children, most of the respondents' parents had 1-2 children. Nineteen (47.5%) respondents in the intervention group and eleven (28.9%) in the control group did not have other family members at home. Low income or wage can be related to a person's low levels of health literacy (Ng & Omariba, 2010).

The majority of the duration of gadget use in both groups was less than 1 hour, and most of the respondents in both groups could easily access the internet. During the COVID-19 pandemic, children are highly exposed to gadgets and the internet because the school system has shifted to an online setting. Children are increasingly using gadgets for learning and other purposes. A study conducted at a Public Elementary School showed that teachers delivered lessons and gave assignments through Google Meet or WhatsApp groups. Gadgets can help rapidly develop children's learning skills because children are more interested in gadgets than books. Gadgets allow children to easily access educational websites and obtain detailed information on the required topics (Sundus, 2018).

Information about COVID-19 had been received by all respondents in the intervention group but only by two people (5.3%) in the control group. Additionally, 30% of respondents in the intervention group and 34.2% in the control group had family members exposed to COVID-19. This finding can be linked to the large number of respondents who have received information about COVID-19, especially those whose families had been infected with COVID-19.

Ease of internet access allows children to find health information easily. Lack of internet access contributes to low health literacy levels and is associated with limited health literacy levels (Levy et al., 2015). Accessibility of health information through mass media and the internet is closely related to health behavior, information seeking, and a person's health achievements and is one of the most important factors affecting health literacy (Abd-Rahim et al., 2021; Levin-Zamir & Bertschi, 2018).

This study showed that the most dominant factor influencing health literacy is the intervention in health education using animated videos and comics. Media and educational processes in accordance with the respondents' characteristics are essential in achieving communication goals in the form of changes in attitudes, opinions, behavior, and social changes (Indrianingsih et al., 2020). Due to data limitations, some variables have not been included in this study, such as the frequency and duration of reading interactive comics and the involvement of parents or caregivers in accompanying children using these interactive comics. Therefore, further research involving more factors contributing to the health literacy of school-aged children is needed.

Implications of the Study

The study highlights the importance of targeted health education initiatives for school-aged children, particularly in COVID-19 prevention. Integrating interactive media tools like animated videos and comics into school curricula can effectively enhance children's health literacy. Healthcare policymakers and managers can leverage these insights to allocate resources towards developing and disseminating engaging health education materials. Collaboration with schools, community organizations, and parents can amplify the reach and impact of such initiatives. Additionally, in today's era, integrating artificial intelligence (AI)-driven personalized learning platforms may be further optimize the delivery of tailored health education content, ensuring that it meets the individual learning needs and preferences of children. This integration of AI technologies into healthcare policy and management practices may enhance the effectiveness and inclusivity of health literacy initiatives, empowering children to navigate health challenges confidently in the digital age. Looking forward, the lessons learned from this study can inform post-pandemic health education strategies, ensuring that children remain well-informed and prepared to address future health crises.

Conclusion

No significant difference was observed between the group that received both animated videos and a comic and the group that received only animated videos. However, significant differences were noted in the intervention group that received education through interactive videos and comics, indicating that COVID-19 prevention education using interactive comics and animated videos could impact the health literacy of school-age children. It is recommended that animated videos and interactive comics be integrated into children's education to enhance their health literacy. These findings suggest that healthcare

policymakers should prioritize the integration of interactive media tools into health education curricula to effectively promote health literacy among school-age children.

Declaration of Conflicting Interest

The authors declared no conflict of interest in this study.

Funding

Funded by Universitas Gadjah mada.

Acknowledgment

The authors appreciate the helpful proofreading from the expert at the Universitas Gadjah Mada.

Authors' Contributions

ILA performed the literature review and collected the data. ILA, FH, and LL conceptualized and analyzed the data. FH and LL supervised and critically reviewed the manuscript. All authors have read and agreed to the final version of the paper.

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Data Availability Statement

The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Declaration of the Use of AI in Scientific Writing

None declared.

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How to Cite This Article

Abdillah, I. L., Haryanti, F., & Lusmilasari, L. (2024). COVID-19 prevention education using interactive comic and animated videos on the health literacy of school-aged children: Implications for healthcare policy and management. *Journal of Healthcare Administration*. <https://doi.org/10.33546/joha.2321>