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Enhancing Preschool Children's Toothbrushing Independence Through Video Tutorial Education: A Study on Knowledge and Practices

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ABSTRACT Preschool children represent a critical developmental stage in which foundational health behaviors, including toothbrushing, begin to form. Although most Indonesian children aged ≥3 years brush their teeth daily, only a small proportion do so correctly, resulting in persistently high rates of dental and oral health problems. This study addresses the problem of low toothbrushing knowledge and inadequate brushing practices among preschool children. The aim of this research was to evaluate the effectiveness of video tutorial–based dental health education in enhancing preschool children's independence, knowledge, and practical skills in toothbrushing. A pre-experimental study with a pre-test–post-test control group design was conducted among 38 preschool children enrolled in Putra Harapan Kindergarten and Dewi Sartika Kindergarten, Tuban. Participants were divided into an experimental group receiving video tutorial education and a control group receiving verbal education only. Data on knowledge and toothbrushing practices were collected using structured observation sheets, and analyzed using the Wilcoxon signed-rank test and Mann–Whitney U test. The results demonstrated a significant improvement in both knowledge and toothbrushing practices in the experimental group after 21 days of intervention ($p < 0.001$). In contrast, the control group showed no significant changes in either outcome. Between-group comparisons further indicated that video tutorial education was significantly more effective than verbal instruction in increasing correct toothbrushing knowledge and practices ($p < 0.001$). In conclusion, video tutorial media is an effective educational tool for enhancing preschool children's independence in toothbrushing. Its engaging visual format improves comprehension and encourages children to imitate proper brushing movements, leading to better oral hygiene behaviors. The findings support the integration of video-based learning into early childhood dental health programs and future studies with longer follow-up periods are recommended to assess long-term behavioral retention.

INDEX TERMS Video Tutorial Education, Toothbrushing Independence, Preschool Children, Oral Health Knowledge, Brushing Practices

I. INTRODUCTION

Dental and oral health in early childhood is a critical component of overall well-being, as inadequate hygiene practices at a young age can lead to persistent caries, periodontal problems, and diminished quality of life [1]. Despite national campaigns promoting proper toothbrushing, the prevalence of dental caries among Indonesian preschoolers remains high, with more than 80% of children aged 3–6 years experiencing caries or plaque accumulation due to improper brushing techniques [2], [3]. Although daily toothbrushing is widely practiced, only a small fraction of preschool children perform brushing correctly, indicating a substantial gap between behavior and skill acquisition [4]. This condition suggests that conventional verbal education alone is insufficient to foster effective toothbrushing skills, and highlights an urgent need for improved, child-friendly educational strategies.

Recent advancements in health promotion emphasize the integration of digital media, particularly video-based learning, as an effective tool to improve comprehension, motor imitation, and behavioral consistency in young children [5]–[8]. Video tutorials, which combine auditory and visual cues, provide clear demonstrations of correct brushing movements and have shown superior engagement compared to traditional leaflets, posters, and verbal instruction [9], [10]. Studies have demonstrated that multimedia learning enhances memory retention, encourages active participation, and increases motivation, especially among preschool learners who respond strongly to visual stimuli and animated content [11]–[14]. Within dental health education, video modeling has been successfully applied to populations including typically developing children and those with special needs, demonstrating improvements in brushing accuracy, duration, and consistency [15]–[18].

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However, despite growing evidence on the benefits of video-based education, research specifically focusing on preschool children's toothbrushing independence—defined as the ability to perform brushing correctly without adult assistance remains limited. Existing studies primarily examine knowledge improvement or general hygiene behavior rather than independence as a behavioral outcome [19], [20]. Furthermore, few studies compare video tutorial methods with conventional verbal education using controlled experimental designs, leaving a gap in understanding the magnitude of effectiveness between these approaches [21], [22]. Additionally, little attention has been given to systematic multi-stage intervention frameworks, such as 21-day habit-formation models, in evaluating the sustainability of toothbrushing skills in early childhood [23]. These gaps highlight the need for more robust, comparative studies to guide evidence-based recommendations for preschool health education.

Therefore, the aim of this study is to evaluate the effectiveness of video tutorial education in enhancing preschool children's independence, knowledge, and practices in toothbrushing when compared to traditional verbal instruction. The contributions of this study are as follows:

1. Providing empirical evidence on the effectiveness of video tutorial–based health education in improving toothbrushing independence among preschool children.
2. Offering a comparative analysis between video tutorial methods and conventional verbal approaches using a structured pre-test/post-test control group design.
3. Introducing a habit-formation intervention timeline (21-day model) to assess behavioral reinforcement and the sustainability of brushing practices in early childhood settings.

The remainder of this article is structured as follows: Section II presents the research methodology, including design, sampling, and data collection procedures. Section III reports the findings of the intervention. Section IV discusses the results in relation to existing literature. Section V concludes the study by summarizing key outcomes and offering recommendations for future research.

II. METHODS

This study employed a pre-experimental analytical design using a pre-test and post-test control group approach to determine the effectiveness of video tutorial education in improving preschool children's independence, knowledge, and practical skills in toothbrushing. The methodology was structured to ensure replicability by detailing the study setting, sample selection procedures, intervention design, materials used, data collection tools, variable operationalization, and statistical analysis methods.

A. STUDY SETTING AND DURATION

The study was conducted at Putra Harapan Kindergarten and Dewi Sartika Kindergarten, located in Tuban Regency, Indonesia. These institutions were selected because both schools have similar demographic and educational environments, minimizing external variability. The research took place over a three-month period (January–March 2023), enabling researchers to implement a structured 21-day educational intervention and follow-up assessments. The study adhered to institutional ethical standards, and informed consent was collected from parents or guardians prior to participation.

B. STUDY DESIGN

A quasi-experimental pre-test–post-test control group design was selected, given the logistical constraints of random assignment within a classroom environment. The experimental group received video tutorial–based education, whereas the control group received standard verbal instruction on toothbrushing. This design allows for comparison of changes within and between groups, consistent with established methodological recommendations for educational intervention research [26], [27].

C. POPULATION AND SAMPLING

The study population consisted of 38 preschool children aged 5–6 years enrolled in group B classes at the two kindergartens. Participants were divided into two groups:

1. 19 children in the experimental group (Putra Harapan)
2. 19 children in the control group (Dewi Sartika)

A total population sampling technique was used due to the small number of eligible children and to ensure representation of the entire preschool cohort. Inclusion criteria included: (1) children aged 5–6 years; (2) able to follow instruction; (3) enrolled full-time; and (4) parental consent obtained. Children with motor disabilities or cognitive impairments affecting brushing ability were excluded to maintain measurement consistency.

D. INTERVENTION PROCEDURES

The intervention followed a structured 21-day habit formation model, comprising three sequential phases designed to support knowledge acquisition, skill development, and independent practice [28]:

1. Phase 1 (Day 1–7): Intensive Education

The experimental group received daily 15-minute video tutorial sessions, featuring animations demonstrating correct toothbrushing techniques. The content included steps such as applying toothpaste, brushing different tooth surfaces, rinsing, and cleaning the toothbrush. Meanwhile, the control group received verbal instruction only, delivered by teachers without visual aids beyond traditional explanations.

2. Phase 2 (Day 8–14): Guided Practice

Children in both groups practiced toothbrushing under supervision. Teachers and parents were instructed to encourage correct brushing techniques without physically assisting the children unless necessary.

3. Phase 3 (Day 15–21): Independent Practice

Children were encouraged to brush independently, allowing researchers to assess behavioral retention. No additional educational materials were provided during this phase to minimize intervention bias.

E. MATERIALS

The primary educational material for the experimental group was a custom-designed video tutorial, optimized for

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preschool comprehension with clear animations, slow-paced demonstrations, child-friendly narration, and simplified steps. The control group received no multimedia material. Additional materials included:

1. Standard child toothbrushes
2. Fluoridated toothpaste
3. Disposable rinsing cups
4. Dental hygiene posters (for environmental consistency)

F. DATA COLLECTION INSTRUMENTS

Data were collected using structured observation sheets developed based on validated toothbrushing assessment frameworks used in pediatric oral health research [29], [30]. Two primary variables were measured:

1. Knowledge of Toothbrushing

A 10-item checklist assessed children's recognition of correct brushing procedures. Each correct response was scored 1, and incorrect responses scored 0.

2. Toothbrushing Practices

Practical skills were evaluated through direct observation using a 12-step brushing procedure covering: toothbrush grip, brushing sequence, duration, and cleaning actions. Scores were categorized as:

a. Very Good (80–100)
b. Good (70–79)
c. Moderate (60–69)
d. Needs Guidance (<60)

All observations were conducted by trained assessors to ensure consistency and reduce interobserver variability.

G. DATA COLLECTION PROCEDURE

Baseline (pre-test) data were recorded before any educational intervention. The same checklists were administered again after the 21-day intervention period. Observations were conducted individually in a controlled setting to avoid peer influence. Teachers were instructed not to provide additional oral hygiene instruction outside the planned intervention to prevent contamination.

H. DATA ANALYSIS

Data were analyzed using SPSS version 25. Normality tests were conducted using the Shapiro–Wilk test, given the small sample size. The results indicated non-normal data distribution for both knowledge and practice variables; therefore, non-parametric tests were employed.

1. Wilcoxon Signed-Rank Test evaluated changes in each group before and after intervention.
2. Mann–Whitney U Test compared post-test results between the experimental and control groups to determine differential effectiveness.

These statistical approaches are consistent with recommended practices for non-parametric, small-sample educational research [31]–[33].

III. RESULT

Shown in TABLE 1 Men (50%) and women (50%) were the same number of people who participated in this study. The majority of respondents (86.8%) were under the age of six.

TABLE 2 shows that there was an expansion in the information on respondents in the trial bunch in the wake of getting training, with 14 out of 19 respondents (73.7%) arriving at a decent degree of information. This demonstrates that respondents' brushing knowledge can be increased through educational media like video tutorials. Then there was an increase in the practices of respondents in the experimental group after receiving education, with 13 of 19 respondents (68.4%) reaching a very good level of knowledge. This demonstrates that respondents' ability to brush their teeth can be improved through educational media like video tutorials.

TABLE 1
Characteristics of Respondent

Characteristic		Frequence (N)	Precentage (%)
Gender	Boy	19	50
	Girl	19	50
Age	5 years old	5	13,2
	6 years old	33	86,8

TABLE 2
The Experimental Group's Frequency Distribution of Preschool Children's Knowledge and Practices Regarding Tooth Brushing Before and After Instruction with Tutorial Videos

Variable Knowledge about tooth brushing	Before		After	
	Frequence (N)	Percentage (%)	Frequence (N)	Percentage (%)
Good	0	0	14	73,7
Moderate	10	52,6	5	26,3
Poor	9	47,4	0	0
Total	**19**	**100**	**19**	**100**
Tooth Brushing Practice	**Before**		**After**	
	Frequence (N)	**Percentage (%)**	**Frequence (N)**	**Percentage (%)**
Very good	0	0	13	68,4
Good	0	0	4	21,1
Moderate	6	31,6	2	10,5
Supervision needed	13	68,4	0	0
Total	**19**	**100**	**19**	**100**

TABLE 3
Knowledge and Practices Regarding Teeth Brushing in Preschool Children Before and After Education (Control Group)

Variable Knowledge about tooth brushing	Before		After	
	Frequence (N)	Percentage (%)	Frequence (N)	Percentage (%)
Good	0	0	0	0
Moderate	6	31,6	8	42,1
Poor	13	68,4	11	57,9
Total Knowledge about tooth brushing	**19**	**100**	**19**	**100**
Tooth Brushing Practice	**Before**		**After**	
	Frequence (N)	**Percentage (%)**	**Frequence (N)**	**Percentage (%)**
Very good	0	0	0	0
Good	0	0	1	5,3
Moderate	3	15,8	2	10,5
Supervision needed	16	84,2	16	84,2
Total	**19**	**100**	**19**	**100**

Shown in TABLE 3, 11 out of 19 respondents (57.9%) exhibited a lack of knowledge, indicating that there was no

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increase in knowledge among respondents in the control group after receiving education. This shows that verbal education is less effective in increasing respondents' knowledge of brushing their teeth. Then there was no increase in the practices of respondents in the control group after receiving education, with 16 out of 19 respondents (84.2%) indicating the practice level needed guidance. This shows that verbal training is less viable in working on respondents' practices in cleaning their teeth.

TABLE 4
Data from the Normality Test on the Knowledge of Brushing Teeth by Preschool Children in the Experimental and Control Groups

Class	Shapiro Wilk		
	Statistic	Df	Sig.
The Intervention Group's Pre-Test	0.873	19	0.016
The Intervention Group's Post-Test	0.796	19	0.001
Control Group Pre-Test	0.843	19	0.005
Control Group Post-Test	0.823	19	0.003

Based on TABLE 4, it was found that the data normality score in the video experiment pretest group had a sig value of 0.016, the video experiment posttest had a sig value of 0.001, the data was not normally distributed. Meanwhile, the pre-test control with a sig value of 0.005, post-test control 0.003, the data was not distributed normally, due to the Sig value is <0.05

TABLE 5
Data from the Normality Test on the Practices for Brushing Their Teeth by Preschool Children in the Experimental Group and the Control Group's

Class	Shapiro Wilk		
	Statistic	df	Sig.
The Intervention Group's Pre-Test	0.814	19	0.002
The Intervention Group's Post-Test	0.853	19	0.007
Control Group Pre-Test	0.803	19	0.001
Control Group Post-Test	0.870	19	0.015

Based on TABLE 5, it was found that the data normality score in the video experiment pre-test group had a sig value of 0.002, the video experiment post-test had a sig value of 0.007, the data was not normally distributed. Meanwhile, the pre-test control has a sig value of 0.001, the post-test control is 0.015, the data also have a non-normal distribution. Because the Sig value is less than 0.05, the data above does not follow a normal distribution.

TABLE 6
Results of the Wilcoxon Test of Preschool Children's Knowledge of Brushing Teeth Before and After Education Using Tutorial Videos (Experimental Group)

Variable	Category			*P* Value
	Good	Moderate	Poor	
Before Education	0	10	9	**0.000**
After Education	14	5	0	

Based on the results presented in TABLE 6, the ρ value of 0.000 indicates a statistically significant increase in children's knowledge of toothbrushing after receiving education through video tutorial media. This finding demonstrates that video-based instruction effectively enhances children's understanding of proper toothbrushing procedures.

TABLE 7
Results of the Wilcoxon Test of Preschool Children's Knowledge of Brushing Teeth Before and After Education Using Non-Video Tutorials (Control Group)

Variable	Category			*P* Value
	Good	Moderate	Poor	
Before Education	0	6	13	**0.157**
After Education	0	11	8	

Referring to TABLE 7, the ρ value of 0.157 shows that there was no significant improvement in toothbrushing knowledge before and after education using non-video instructional methods. This result suggests that verbal or traditional forms of education do not substantially influence children's understanding of toothbrushing techniques.

TABLE 8
Wilcoxon Test Results of Preschool Children's Practices in Brushing Teeth Before and After Education Using Tutorial Videos (Experimental Group)

Variable	Category				*P* Value
	Very Good	Good	Moderate	Supervision Needed	
Before Education	0	0	6	13	**0.000**
After Education	13	4	2	0	

The results in TABLE 8 reveal a ρ value of 0.000, indicating a significant change in children's toothbrushing skills before and after receiving counseling with video tutorial media. These findings confirm that video-based instruction meaningfully improves the practical ability of children to perform correct toothbrushing movements.

TABLE 9
Results of the Wilcoxon Test of Preschool Children's Skills in Brushing Teeth Before and After Counseling Using Non-Video Tutorials (Control Group)

Variable	Category				P Value
	Very Good	Good	Moderate	Supervision Needed	
Before Education	0	0	3	16	**0.083**
After Education	0	1	2	16	

As shown in TABLE 9, the ρ value of 0.083 signifies that there was no significant variation in toothbrushing skills before and after education using non-video tutorial media. This demonstrates that conventional verbal education alone is insufficient to produce measurable improvements in children's toothbrushing performance.

Based on TABLE 10, the ρ value is 0.000, so H_0 is dimissed and H_1 is acknowledged, the effectiveness of using video tutorials to teach preschoolers at Putra Harapan Kindergarten and Dewi Sartika Kindergarten Tuban about brushing their teeth is significantly different.

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TABLE 10
Differences in the Effectiveness of Education Using Video Tutorials to Increase Knowledge of Teeth Brushing in Preschool Children

Mann Whitney Test

Group	Practice						*P* Value
	Good		Moderate		Poor		
	N	%	N	%	N	%	
Intervention Group (Video Tutorial)	14	73,7	5	26,3	0	0	**0.000**
Control Group	0	0	8	42,1	11	57,9	

TABLE 11
Differences in the Effectiveness of Education Using Video Tutorials to Improve Teeth Brushing Practices in Preschool Children

Mann Whitney Test

Group	Practice								*P* Value
	Very Good		Good		Moderate		Supervision Needed		
	N	%	N	%	N	%	N	%	
Intervention Group (Video Tutorial)	13	68,4	4	21,1	2	10,5	0	0	**0.000**
Control Group	0	0	1	5,3	2	10,5	16	84,2	

Based on TABLE 11, the ρ value is 0.000, so H_0 is dimissed and H_1 is acknoledged, thus there is a significant difference in effectiveness between education using video tutorials to improve the teeth brushing practices of preschool children at Putra Harapan Kindergarten and Dewi Sartika Tuban Kindergarten.

Based on the results obtained from this study, it shows that the data is in accordance with the results obtained. The limitations of the researchers in conducting this study may have an impact in the future. The limitations of researchers in this study are the short time, so researchers use time as effectively as possible to conduct research in the same place at once.

IV. DISCUSSION

A. INTERPRETATION OF THE FINDINGS

The findings of the present study demonstrate that video tutorial–based education is a highly effective strategy for improving preschool children's knowledge and practical skills in toothbrushing. Significant improvements were observed in the experimental group across both variables after the 21-day intervention, whereas the control group receiving only verbal instruction showed minimal change. These results highlight that children are more responsive to visual and audio-visual learning tools compared to conventional methods.

One of the key explanations for this improvement lies in the developmental characteristics of preschool children. At the age of 5–6 years, children rely heavily on sensory stimulation and imitation-based learning, making video tutorials particularly suitable for facilitating behavioral acquisition. Animated demonstrations, clear sequencing, and repeated exposure allowed children to internalize the steps of toothbrushing more effectively. This aligns with theories of observational learning, which emphasize that modeled behavior, when visually displayed, strengthens comprehension and replication of motor tasks.

Moreover, the structured 21-day program facilitated reinforcement and habitual formation. The gradual transition from intensive education to guided practice and then independent brushing provided consistent exposure and opportunities for mastery. The notable improvement in independence observed at the end of the intervention suggests that repeated demonstrations combined with self-directed practice enhance children's confidence and autonomy. Such findings reinforce the principles of habit formation in early childhood, where consistent repetition over a set period contributes to long-term behavioral adoption.

The contrast between the experimental and control groups further reveals the limitations of standard verbal education. While teachers provided instructions verbally, the absence of visual guidance limited children's ability to translate verbal information into coordinated brushing movements. This is consistent with cognitive learning theories, which propose that abstract instructions without visual support can be difficult for early learners to process. As a result, children in the control group displayed minimal improvement despite being exposed to the same content. Overall, the study's results emphasize that educational media must be developmentally appropriate, engaging, and visually guided to effectively support children's acquisition of oral hygiene skills.

B. COMPARISON WITH PRIOR STUDIES

The outcomes of this study are consistent with a growing body of evidence demonstrating the superiority of video-based education in improving toothbrushing skills among young learners. Several recent studies have reported that video modeling enhances children's understanding of toothbrushing steps and reinforces their ability to perform the movements accurately [34], [35]. For example, Chawla and Goswami (2021) found that video demonstrations significantly enhanced procedural comprehension in children compared to traditional instruction, supporting the current findings that video tutorials are more effective than verbal explanations alone.

Similarly, Ismail et al. (2023) demonstrated that video modeling improved toothbrushing proficiency in children with developmental disorders, stressing the universal applicability of visual learning tools across different learner groups. The present study extends these findings to typically developing preschool children, showing that the same instructional method yields substantial improvements in both knowledge and practical performance.

The effectiveness of video-based learning can also be linked to findings from classroom-based digital education research. Nabayra (2022) reported that teacher-created videos increased student engagement, motivation, and learning outcomes across subjects, while Pravitasari and Vulandari (2023) found that tutorial videos enhanced cognitive performance in elementary students. These studies confirm that video tutorials promote deeper learning due to their ability to combine auditory, visual, and dynamic elements that are not present in traditional instruction.

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In contrast, studies evaluating verbal or lecture-based education consistently point out limitations similar to those identified in this study. Tony et al. (2021) observed that verbal counseling alone leads to minimal behavioral change, as learners often fail to retain or interpret complex procedural information. Similarly, Indrawati (2021) noted that without visual reinforcement, learners show reduced motivation and lower retention of instructional content. These findings parallel the minimal improvement observed in the control group of the present study.

However, some studies suggest complementary findings. A study by Larsen (2020) emphasized that habit formation requires not only visual stimulation but also environmental support from teachers and families. The guided practice phase in the present study appears to bridge this gap by involving parents and teachers in encouraging consistent brushing behavior. Thus, the integration of video tutorials with supervised practice may explain the strong improvement found in this study.

Overall, the present findings reinforce prior evidence while also providing a structured intervention model that uniquely combines video learning with habit reinforcement, thereby contributing a more holistic approach to early childhood oral hygiene education.

C. LIMITATIONS, WEAKNESSES, AND IMPLICATIONS

While the study provides valuable insights, several limitations should be acknowledged. First, the research was conducted in only two kindergartens within a single district, which may limit the generalizability of the findings. Expanding the study to multiple regions with varied socioeconomic characteristics would enhance external validity.

Second, the study employed a quasi-experimental design without randomization due to classroom constraints. Although the two groups shared similar baseline characteristics, the absence of random assignment may allow for potential selection bias. Future studies may consider cluster-randomized designs to strengthen causal inference.

Third, the intervention period lasted 21 days, which is suitable for habit formation but insufficient to assess long-term behavioral retention. Children may revert to previous habits over time without ongoing reinforcement. Longitudinal follow-up assessments would be needed to determine whether the improvements are sustained beyond the intervention period.

Fourth, the study relied on observation-based scoring to measure toothbrushing skills. Although trained assessors were used, some degree of subjectivity is unavoidable. Incorporating video-recorded assessments or inter-rater reliability checks would strengthen methodological rigor.

Another limitation concerns the nature of video content. While the tutorial was designed for preschoolers, individual differences in attention span, cognitive development, and prior experience might influence the extent to which children benefit from the material. Tailoring video content to different developmental levels may optimize learning outcomes.

Despite these limitations, the study offers several important implications. The strong impact of video tutorials underscores the potential for multidisciplinary integration of digital media into early childhood health curricula. Schools can adopt similar audiovisual materials to reinforce daily hygiene practices. Additionally, the intervention model can be incorporated into parental education programs to promote toothbrushing habits at home, thereby enhancing continuity between school and family environments.

From a policy perspective, the findings highlight the need for early childhood education programs to adopt modern, evidence-based instructional tools. Given the high prevalence of caries in Indonesia, incorporating educational videos into national school health programs may contribute to improving oral health outcomes at a population level.

Moreover, the effectiveness of video-based learning opens opportunities for remote or online health education, particularly in areas with limited access to dental professionals. The scalability and reusability of video materials make them a cost-effective and sustainable educational tool for public health interventions.

Lastly, this study contributes to the literature by providing a structured framework combining video learning, guided practice, and independent strengthening phases. This hybrid model may be applied to other health behaviors, such as handwashing, nutrition, or personal hygiene education.

V. CONCLUSION

This study examined the effectiveness of video tutorial–based education in enhancing preschool children's independence, knowledge, and practical skills in toothbrushing. The findings demonstrate that the structured 21-day video-supported intervention was successful in significantly improving children's comprehension of correct brushing techniques and their ability to perform these skills independently. The experimental group showed substantial progress across all measured variables, while the control group, which received only verbal instruction, displayed minimal improvement. These results highlight the importance of developmentally appropriate, visually guided educational tools in promoting essential health behaviors among young children.

The use of animated video tutorials proved particularly impactful due to their ability to provide clear demonstrations, sustain attention, and promote imitation-based learning—key components of cognitive development in early childhood. The integration of repeated exposure, guided reinforcement, and independent practice further contributed to habit formation, allowing children to internalize correct toothbrushing behavior more effectively than through traditional verbal explanations. The observed increase in brushing independence underscores the potential of multimedia learning to strengthen motor coordination, motivation, and self-efficacy in preschool-aged learners.

The study's results align with recent evidence supporting the use of digital and video-assisted educational methods in health promotion. However, this study also contributes an additional dimension by applying a structured habit-building model, demonstrating that consistent, phased interventions can enhance and sustain behavioral outcomes.

Despite its strengths, the study acknowledges several limitations, including the restricted sample size, the quasi-experimental design without randomization, and the absence of long-term follow-up. Nevertheless, the implications are substantial. Incorporating video tutorial–based oral hygiene

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education into early childhood curricula may serve as an effective and scalable strategy to reduce the prevalence of dental problems in young children. Future research is encouraged to include larger samples, randomized designs, and extended observation periods to evaluate the long-term sustainability of behavioral improvements.

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DATA AVAILABILITY

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

AUTHOR CONTRIBUTION

All authors contributed substantially to the completion of this study. Silvia Prasetyowati was responsible for the conceptualization of the research, development of the study design, coordination with participating institutions, supervision of data collection, and critical review of the manuscript. Meyvilia Yunardi Saputri conducted the data analysis, refined the methodological framework, prepared the initial draft of the manuscript, and contributed to data visualization. Isnanto supported the literature review process, assisted with instrument validation, contributed to manuscript editing, and provided final approval of the completed version. All authors reviewed and approved the final manuscript prior to submission.

DECLARATIONS

ETHICAL APPROVAL

Ethical permission was obtained from the institutional ethics committee of the Health Polytechnic of the Ministry of Health Surabaya. Informed consent was obtained from all parents or legal guardians prior to participation in the study.

CONSENT FOR PUBLICATION PARTICIPANTS.

All authors consent to the publication of this manuscript.

COMPETING INTERESTS

The authors declare that there are no conflicts of interest related to the publication of this study.

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