

THE EFFECT OF THE ORAL HEALTH EDUCATION MODEL ON KNOWLEDGE, ATTITUDES, AND TOOTHBRUSHING SKILLS OF CHILDREN WITH INTELLECTUAL DISABILITIES IN SPECIAL SCHOOLS (SLB) IN INDONESIA

EFECTO DEL MODELO DE EDUCACIÓN EN SALUD BUCAL SOBRE EL CONOCIMIENTO, ACTITUDES Y HABILIDADES DE CEPILLADO DENTAL EN NIÑOS CON DISCAPACIDAD INTELECTUAL EN ESCUELAS ESPECIALES (SLB) EN INDONESIA

O EFEITO DO MODELO DE EDUCAÇÃO EM SAÚDE BUCAL SOBRE O CONHECIMENTO, AS ATITUDES E AS HABILIDADES DE ESCOVAÇÃO DENTÁRIA EM CRIANÇAS COM DEFICIÊNCIA INTELECTUAL EM ESCOLAS ESPECIAIS (SLB) NA INDONÉSIA

ISSN 0717-9553

CIENCIA Y ENFERMERIA (2026) 32:13

DOI

<https://doi.org/10.29393/CE32-13HKHM40013>



Corresponding author

Hendry Boy

Key words

Oral health education; Intellectual disability; Toothbrushing skills; Educational mode; Children, Teachers.

Palabras clave

Educación para la salud bucal; Discapacidad intelectual; Técnicas de cepillado dental; Modelo educativo; Niños; Profesores.

Palavras-chave

Educação para a saúde bucal; Deficiência intelectual; Técnicas de escovação dentária; Modelo educativo; Crianças; Professores.

Date received

23/01/2026

Date accepted

13/06/2026

Editora

Dra. Sara Mendoza-Parra 

Hendry Boy¹  Email: hendryboy@poltekkesjambi.ac.id

Muhammad Rusdi²  Email: rusdi@unja.ac.id

Solha Elrifda³  Email: solha@unja.ac.id

Intan Lestari⁴  Email: ilestari_15@unja.ac.id

ABSTRACT

Objective: To develop and analyze the effectiveness of an oral health education model in improving the knowledge, attitudes, and toothbrushing skills of children with intellectual disabilities in Special Schools (SLB). **Materials and Methods:** Quasi-experimental study with pre-test, post-test and control group, completed in 2025. The study population consisted of all teachers (10) and children with intellectual disabilities (60) with intellectual disabilities from two state SLB schools in the city of Jambi, Indonesia. 70 participants (60 children and 10 teachers) were selected through purposive sampling, with 35 participants (30 children and 5 teachers) in each intervention and control group. The research instruments included a knowledge questionnaire, an attitude scale, and a toothbrushing skills observation checklist. All instruments underwent validity and reliability testing, and a pilot test was conducted prior to the main study to ensure clarity, feasibility, and measurement consistency. Data were analyzed using repeated measures ANOVA, post-hoc LSD test, and independent t-test with a significance level of $p = < 0.05$. **Results:** The oral health education model developed for children with children intellectual disabilities was proven effective in increasing

¹S.Si.T., MDSc, Department of Oral and Dental Health, Faculty of Mathematics and Natural Sciences Education, University of Jambi, Jambi, Indonesia.

²S.Pd., M.Sc, Dr, Department of Physical Chemistry, Faculty of Mathematics and Natural Sciences Education, University of Jambi, Jambi, Indonesia.

³S.Pd., M.Kes, Dr. Department of Public Health, Faculty of Mathematics and Natural Sciences Education, University of Jambi, Jambi, Indonesia.

⁴S.Si., M.Si, Department of Analytical Chemistry, Faculty of Science and Technology, University of Jambi, Jambi, Indonesia.

their knowledge, attitudes, and toothbrushing skills. The analysis showed a significant improvement between pre-test and post-test scores in the intervention group ($p= 0.000$). The independent t-test also revealed significant differences between the intervention and control groups for all variables ($p= < 0.05$). Conclusion: The oral health education model is effective in improving the knowledge, attitudes, and toothbrushing skills for children with intellectual disabilities.

RESUMEN

Objetivo: Desarrollar y analizar la efectividad de un modelo de educación para la salud bucal en la mejora del conocimiento, las actitudes y las habilidades de cepillado dental de niños con discapacidad intelectual en escuelas especiales (SLB). **Material y Método:** Estudio cuasiexperimental con pre-test, pos-test y grupo control realizado en el año 2025. La población de estudio estuvo conformada por todos los profesores (10) y niños con discapacidad intelectual (60) de dos escuelas SLB en la ciudad de Jambi, Indonesia. Se seleccionaron 70 participantes (60 niños y 10 profesores) mediante muestreo intencional, con 35 participantes (30 niños y 5 profesores) en cada grupo de intervención y control. Los instrumentos aplicados incluyeron un cuestionario de conocimiento, una escala de actitudes y una lista de verificación para la observación de las habilidades de cepillado dental. Todos los instrumentos fueron sometidos a pruebas de validez y confiabilidad, y se realizó una prueba piloto antes del estudio principal para garantizar la claridad, la viabilidad y la consistencia de la medición. Los datos se analizaron mediante ANOVA de medidas repetidas, prueba post-hoc LSD y prueba t independiente con un nivel de significancia de $p < 0,05$. **Resultados:** El modelo de educación para la salud bucal desarrollado demostró ser eficaz para aumentar el conocimiento, las actitudes y las habilidades de cepillado dental en niños con discapacidad intelectual. El análisis mostró una mejora significativa entre las puntuaciones pre-test y post-test en el grupo de intervención ($p= 0,000$). La prueba t independiente también reveló diferencias significativas entre los grupos de intervención y control para todas las variables ($p= < 0,05$). **Conclusión:** El modelo de educación para la salud bucal para niños con discapacidad intelectual es eficaz para mejorar el conocimiento, las actitudes y las habilidades de cepillado dental.

RESUMO

Objetivo: Desenvolver e analisar a eficácia de um modelo de educação para a saúde bucal na melhoria do conhecimento, as atitudes e as habilidades de escovação dentária de crianças com deficiência intelectual em escolas especiais (SLB) na Indonésia. **Material e Método:** Estudo cuasiexperimental com pré-teste, pós-teste e controle de grupo desenvolvido no ano de 2025. A população do estudo consistiu em todos os professores (10) e crianças com deficiência intelectual (60) de duas escolas estaduais SLB na cidade de Jambi, Indonésia. Por meio de amostragem intencional, foram selecionados 70 participantes (60 crianças e 10 professores), com 35 participantes (30 crianças e 5 professores) em cada grupo de intervenção e controle. Os instrumentos aplicados incluíram um questionário de conhecimento, uma escala de atitudes e uma lista de verificação para a observação das habilidades de escovação dentária. Todos os instrumentos foram submetidos a testes de validade e confiabilidade, e foi realizado um teste piloto antes do estudo principal para garantir a clareza, a viabilidade e a consistência da medição. Os dados foram analisados através de ANOVA de medidas repetidas, teste post hoc LSD e teste independente com um nível de significância de $p= < 0,05$. **Resultados:** O modelo de educação para a saúde bucal desenvolvido demonstrou ser eficaz para aumentar o conhecimento, as atitudes e as habilidades de escovação dentária em crianças com deficiência intelectual. A análise mostrou uma melhoria significativa entre as pontuações pré-teste e pós-teste no grupo de intervenção ($p= 0,000$). O teste independente também revelou diferenças significativas entre os grupos de intervenção e controle para todas as variáveis ($p= < 0,05$). **Conclusão:** O modelo de educação para a saúde bucal de crianças com deficiência intelectual é eficaz para melhorar o conhecimento, as atitudes e as habilidades de escovação dentária.

INTRODUCTION

Oral health is an integral part of overall body health⁽¹⁾. Good oral and dental conditions contribute to optimal body function, self-confidence,

and an individual's quality of life. Conversely, oral disorders such as dental caries, periodontal disease, or malocclusion can affect eating, speaking, and systemic health, and may even

impact a person's psychosocial well-being^(2, 3). Therefore, the development of oral health is an important part of national health development, aimed at improving human resource quality through promotive, preventive, curative, and rehabilitative efforts in a continuous manner⁽⁴⁾.

One classification of children with special needs is children with intellectual disabilities. These children clearly experience delays and impairments in intellectual development well below average, which makes them face difficulties in academic tasks, communication, and social interaction⁽⁵⁾. Intellectual disabilities are classified based on assessment: educable children with an IQ of 68-52, trainable children with an IQ of 51-36, and custodial children with an IQ of 39-25⁽⁶⁾. Individuals with intellectual disabilities demonstrate deficits in intellectual functioning. Adaptive functioning refers to the conceptual, social, and practical skills needed to engage in daily activities at a level expected by developmental and sociocultural standards⁽⁷⁾. Children with intellectual disabilities still have the ability to learn self-development skills, such as toothbrushing, to take care of themselves⁽⁸⁾.

Oral health problems among children with intellectual disabilities are relatively higher compared to those without disabilities. Studies show that the prevalence of periodontal disease, dental caries, and malocclusion in children with intellectual disabilities is approximately 30% higher than in children without disabilities. This condition is caused by suboptimal chewing and swallowing abilities, improper toothbrushing habits, and accumulation of food debris in the oral cavity. In addition, limitations in intellectual functioning lead to low adaptive behavior, including self-care skills such as maintaining hygiene, communication, and interaction with the environment⁽⁹⁾.

Although oral hygiene behavior is very important, many children with intellectual disabilities are unable to perform these activities properly. Surveys in several special schools show that most children with intellectual disabilities do not brush their teeth regularly and do not understand the importance of oral hygiene. Limited fine motor skills, low memory capacity, and short attention spans make consistent toothbrushing difficult without guidance⁽¹⁰⁾. This

creates a gap between the need for proper oral hygiene behavior and the actual ability of children with intellectual disabilities to perform it⁽¹¹⁾.

Several previous studies have attempted to improve toothbrushing skills in children with intellectual disabilities using educational approaches. For example, Sandjojo⁽¹²⁾ demonstrated that basic skills training can help individuals with intellectual disabilities manage daily activities. Similarly, Liu et al.⁽¹³⁾ showed that the chaining technique is effective in improving toothbrushing ability in children with mild intellectual disabilities. However, most studies still focus on short-term effects or rely on a single demonstration method without considering the learning characteristics of children with intellectual disabilities, who require multisensory, engaging, and consistent approaches^(3, 5, 14). Therefore, there is a research gap in terms of comprehensive and contextual educational approaches to improve oral hygiene behavior in children with intellectual disabilities.

Research on oral health education interventions for children with intellectual disabilities is highly urgent because it directly relates to improving their quality of life and independence. The involvement of teachers and educators in the educational process is also a key factor since they interact directly with children daily. Teachers can act as facilitators who provide learning through concrete examples, repetition, and positive reinforcement. Through appropriate training and education, children with intellectual disabilities are expected to improve their toothbrushing skills and understand the importance of oral hygiene as part of self-care^(15, 16).

The novelty of this study lies in the application of an oral health education method tailored to the characteristics of children with intellectual disabilities, using a simple, visual, and participatory approach. This approach not only focuses on improving mechanical toothbrushing skills but also on adaptive behavior changes and health awareness. By integrating the role of teachers as educators and motivators, this intervention is expected to produce a more effective, easily applied, and sustainable educational model in special school settings.

This study aims to analyze the effectiveness of

oral health education on improving knowledge, attitudes, and toothbrushing skills in children with intellectual disabilities. The results are expected to provide practical benefits for teachers and health professionals in designing health education programs that suit the needs of children with special needs. Theoretically, this study can enrich scientific knowledge in the field of health education and dental health for children with disabilities while providing a foundation for school-based interventions aimed at enhancing the independence and quality of life of children with intellectual disabilities in Indonesia.

MATERIAL AND METHOD

Study Design: The research method used in this study was Research and Development (R&D), aimed at designing and developing an oral health education model for children with intellectual disabilities. This model is expected to improve the knowledge, attitudes, and toothbrushing skills of children with intellectual disabilities through an approach tailored to their cognitive and social abilities. This study employed two approaches: a qualitative approach using descriptive methods to explore the learning needs and characteristics of children with intellectual disabilities, and a quantitative approach to assess the effectiveness of the educational model through statistical analysis.

Study Setting and Time: The study was conducted at two state special schools (SLBN) in Jambi city: SLBN 01 as the intervention group and SLBN 02 at the control group. The study was carried out in 2025, with a model trial period of approximately one month, involving three weekly evaluations. The research design used during the model trial was a quasi-experimental design with a pre-test and post-test with a control group design, allowing researchers to compare changes in knowledge, attitudes, and skills between the intervention and control groups before and after the educational intervention.

Population and Sample: The population consisted of all teachers (10) and children (60) with intellectual disabilities at both schools, while the sample was determined using purposive sampling based on predefined inclusion and exclusion criteria. Inclusion criteria for teachers included: actively teaching at the SLBN for at least one year, willing to participate in training and evaluations, and possessing basic skills in assisting children with intellectual disabilities. Inclusion criteria for students included: diagnosed with mild to moderate intellectual disabilities, able to follow simple instructions, and without severe physical impairments that would hinder fine motor skills. Based on these criteria, 5 teachers and 30 students were included in each of the intervention and control groups (Figure 1).

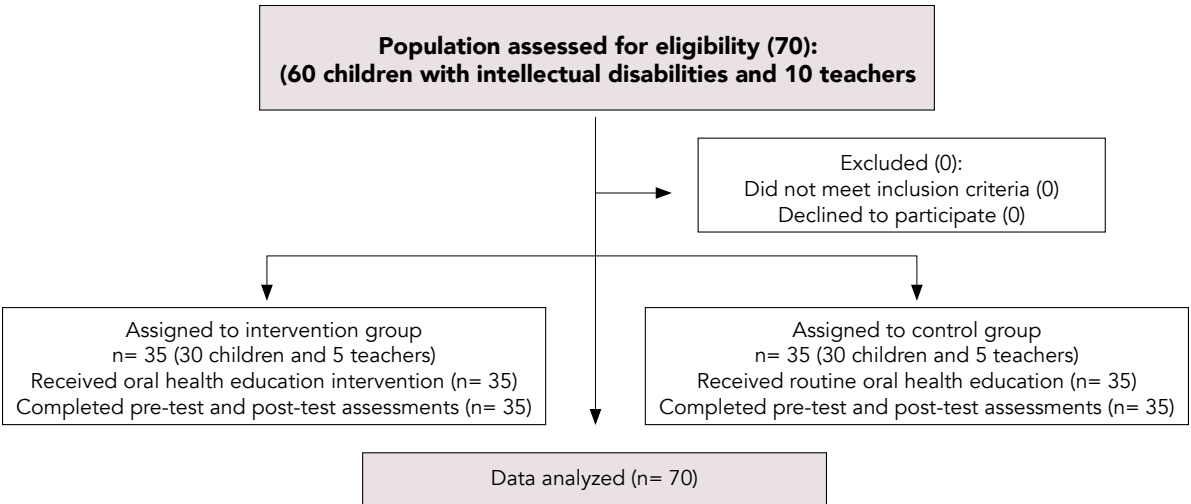


Figure 1. Selection of children with intellectual disabilities and teachers participating in intervention and control groups, in two special schools, Jambi City, Indonesia, 2025 (n= 70).

A total of 70 participants (60 children with intellectual disabilities and 10 teachers) were assessed for eligibility. All participants met the inclusion criteria and completed the study. No participants were excluded or lost to follow-up, and all data were included in the final analysis.

Variables: The study variables consisted of the independent variable, namely the oral health education model, and dependent variables, including the knowledge, attitudes, and toothbrushing skills of children with intellectual disabilities. Knowledge was measured using a closed-ended questionnaire that had been tested for validity and reliability, while toothbrushing skills were assessed using an observation checklist. Assessment indicators included preparation (tools and materials), execution (brushing on buccal, labial, palatal, lingual, occlusal surfaces, and the tongue), and closure (storing tools and materials). Teacher attitudes were measured using a Likert scale ranging from strongly disagree to strongly agree regarding their role in assisting children with intellectual disabilities in oral care.

Data Collection: Data collection was conducted in several stages: pre-test, oral health education intervention, and post-test. The intervention phase included teacher training using educational media developed by the researchers, demonstrations of proper toothbrushing techniques, hands-on practice conducted by teachers together with students, and weekly evaluation sessions to monitor the development of students' toothbrushing skills. Teacher training was conducted in a structured manner during a single main session lasting approximately 90 minutes. The training included basic concepts of oral and dental health in children with intellectual disabilities, principles of visual learning and hands-on practice, and the correct toothbrushing procedures in accordance with the study's assessment indicators.

The training began with the presentation of educational materials using illustrated modules and toothbrushing teaching aids, followed by a demonstration of proper toothbrushing techniques by the researchers. Subsequently, teachers participated in simulated toothbrushing practice using the teaching aids under researcher

supervision to ensure consistency in steps, sequence, and instructional delivery to students. Teachers were also provided with written guidelines outlining their role as facilitators in assisting students during toothbrushing practice. Following the training, teachers implemented the oral health education model directly with students, with ongoing supervision and periodic monitoring by the researchers.

All participants completed the assessments at each stage of the study, and no missing data was identified across all variables. Therefore, all collected data were included in the final statistical analysis without the need for special handling of missing data.

Bias Control: Several strategies were implemented to minimize potential sources of bias in this study. Selection bias was reduced by applying clear inclusion and exclusion criteria and using the same sampling procedure for both intervention and control groups. To minimize measurement bias, all research instruments (knowledge questionnaires and observation checklists) had been previously tested for validity and reliability.

Data collection procedures were standardized across both groups, and observations were conducted by trained field assistants using the same assessment guidelines. Prior to data collection, observers received training to ensure consistency in scoring toothbrushing skills and to reduce inter-observer variability. In addition, repeated measurements were conducted at the same time intervals for both groups to reduce temporal bias.

Statistical Analysis: The collected data were analyzed using bivariate analysis to examine relationships between two variables and differences between groups. Before conducting difference tests, data normality was assessed using the Shapiro-Wilk test. If data were normally distributed, repeated measures ANOVA were used to assess changes in pre-test and post-test mean scores within the intervention and control groups. Additionally, one-way ANOVA was used to compare post-test mean scores between groups, and independent t-tests were used to determine the significance of mean differences between the intervention and control groups. All

data analyses were performed using the latest version of SPSS (Statistical Package for the Social Sciences), with a statistical significance threshold of $p < 0.05$.

RESULTS

Table 1 shows the effect of the oral health education model on children’s knowledge and skills. The mean knowledge score increased from 10.15 ± 1.73 at pre-test to 15.00 ± 0.00 at post-test ($p = 0.000$), indicating a significant improvement. Similarly, the mean skills score improved from 13.25 ± 3.63 at pre-test to 23.00 ± 0.00 at post-test ($p = 0.000$), demonstrating a substantial enhancement in children’s toothbrushing abilities.

Table 2 shows the effect of the oral health education model on children’s toothbrushing skills. In the intervention group, the mean score increased from 4.80 ± 1.42 at pre-test to 15.00 ± 0.00 at the third post-test, while the control group increased from 4.77 ± 1.46 to 12.47 ± 1.22 .

Paired tests showed significant improvement within both groups ($p = 0.000$). Post hoc tests indicated that the intervention group improved consistently at all stages ($p = 0.000$), while the control group only showed significant improvement between Post-test 2 and 3 ($p = 0.000$). Unpaired tests confirmed no difference at pre-test ($p = 0.929$) but significant differences at all post-tests ($p = 0.000$), showing that the intervention group improved more than the control group.

Table 1. Effectiveness of the Oral Health Education Model on Knowledge and Toothbrushing Skills among children with intellectual disabilities in special schools, Jambi City, Indonesia, 2025 (n= 60).

Variable		Mean	SD	Min	Max	p-value
Knowledge	Pre Test	10,15	1,725	6	13	0,000
	Post Test	15,00	0,000	15	15	
Skills	Pre test	13,25	3,626	15	23	0,000
	Post test	23,00	0,000	23	23	

Table 2. Effectiveness of the Oral Health Education Model on Oral Health Knowledge among Children with Intellectual Disabilities in Intervention and Control Groups in Special Schools, Jambi City, Indonesia, 2025 (n= 60).

Variables	Groups	Mean±SD Pre-test	Mean±SD Post-test 1	Mean±SD Post-test 2	Mean±SD Post-test 3	p-value
Paured Test	Intervention	4,80±1,424	8,07±1,230	10,43±1,406	15,00±0,00	0,000
	Control	4,77±1,455	5,07±1,461	5,73±1,552	12,47±1,224	0,000
Paired Post Hoc Test		P-value Pre-post 1	P-value Post test 1, 2	P-value Post test 2,3		
	Intervention	0,000	0,000	0,000		
	Control	0,060	0,114	0,000		
		Mean±SD Pretest	Mean±SD Posttest1	Mean±SD Posttest2	Mean±SD Posttest3	
Unpaired Test	Intervention	4,80±1,424	8,07±1,230	10,43±1,406	15,00±0,00	
	Control	4,77±1,455	5,07±1,461	5,73±1,552	12,47±1,224	
	p-value	0,929	0,000	0,000	0,000	

Table 3 shows the effect of the oral health education model on children's toothbrushing skills. In the intervention group, the mean score increased from 13.87 ± 3.14 at pre-test to 37.17 ± 1.26 at the third post-test, while the control group increased from 14.07 ± 0.47 to 29.17 ± 0.38 .

Paired tests indicated significant improvement within both groups ($p = 0.000$). Post hoc tests showed that the intervention group improved significantly at all stages ($p = 0.000$), whereas the control group showed significant improvement only between Post-test 1–2 ($p = 0.024$) and Post-test 2–3 ($p = 0.000$). Unpaired tests confirmed no difference at pre-test ($p = 0.787$), but significant differences were found at all post-tests ($p \leq 0.001$), indicating that the intervention group achieved greater improvement than the control group.

Table 4 presents the effectiveness of the oral health education model on children's toothbrushing skills. In the intervention group, mean scores increased from 5.27 ± 2.15 at pre-test to 23.00 ± 0.00 at Post-test 3, while the control group increased from 5.30 ± 1.75 to 15.47 ± 2.47 .

Paired tests showed significant improvement within both groups ($p = 0.000$). Post hoc tests indicated that the intervention group improved significantly at all stages ($p = 0.000$), while the

control group only showed a significant increase between Post-test 2 and 3 ($p = 0.000$). Unpaired tests revealed no significant difference at pre-test ($p = 0.948$), but significant differences were observed at all post-tests ($p = 0.000$), showing that the intervention group achieved greater improvement than the control group.

Learning Characteristics of Children with Intellectual Disabilities:

In addition to quantitative outcomes, qualitative observations were conducted to identify the learning characteristics of children with intellectual disabilities during the oral health education intervention. Observational findings showed that most children demonstrated limited attention span and required repeated instructions to complete toothbrushing steps correctly. Visual learning was identified as the dominant learning modality, as children showed better understanding when educational media included pictures, demonstrations, and step-by-step visual cues.

Hands-on practice combined with direct teacher assistance facilitated better skill acquisition compared to verbal instruction alone. Children responded positively to repetitive routines and consistent guidance, indicating that repetition and structured learning sequences were essential for effective skill development.

Table 3. Effectiveness of the Oral Health Education Model on Oral Health Attitudes among Children with Intellectual Disabilities in Intervention and Control Groups in Special Schools, Jambi City, Indonesia, 2025 (n = 60).

Variables	Groups	Mean $\pm$ SD Pre-test	Mean $\pm$ SD Post-test 1	Mean $\pm$ SD Post-test 2	Mean $\pm$ SD Post-test 3	p-value
Paired Test	Intervention	13,87 $\pm$ 3,137	17,00 $\pm$ 3,140	28,13 $\pm$ 1,756	37,170 $\pm$ 1,262	0,000
	Control	14,067 $\pm$ 0,465	14,50 $\pm$ 0,439	14,967 $\pm$ 0,397	29,167 $\pm$ 0,378	0,000
Paired Post Hoc Test		P-value Pretest- Posttest 1	P-value Posttest1- Posttest2	P-value Posttest2- Posttest3		
	Intervention	0,000	0,000	0,000		
	Control	0,125	0,024	0,000		
Unpaired Test		Mean $\pm$ SD Pretest	Mean $\pm$ SD Posttest1	Mean $\pm$ SD Posttest2	Mean $\pm$ SD Posttest3	
	Intervention	13,87 $\pm$ 3,137	17,00 $\pm$ 3,140	28,13 $\pm$ 1,756	37,170 $\pm$ 1,262	
	Control	14,067 $\pm$ 0,465	14,50 $\pm$ 0,439	14,967 $\pm$ 0,397	29,167 $\pm$ 0,378	
	p-value	0,787	0,001	0,000	0,000	

Table 4. Effectiveness of the Oral Health Education Model on Toothbrushing Skills among Children with Intellectual Disabilities in Intervention and Control Groups in Special Schools, Jambi City, Indonesia, 2025 (n= 60).

Variables	Groups	Mean±SD Pre-test	Mean±SD Post-test 1	Mean±SD Post-test 2	Mean±SD Post-test 3	p-value
Paired Test	Intervention	5,27±2,149	11,43±2,861	16,73±2,243	23,00±0,000	0,000
	Control	5,30±1,745	6,23±2,300	7,00±2,378	15,47±2,474	0,000
Paired Post Hoc Test		P-value Pretest- Posttest 1	P-value Posttest1- Posttest2	P-value Posttest2- Posttest3		
	Intervention	0,000	0,000	0,000		
	Control	0,060	0,086	0,000		
		Mean±SD Pretest	Mean±SD Posttest1	Mean±SD Posttest2	Mean±SD Posttest3	
Unpaired Test	Intervention	13,87±3,137	17,00±3,140	28,13±1,756	37,170±1,262	
	Control	14,067±0,465	14,50±0,439	14,967±0,397	29,167±0,378	
	p-value	0,787	0,001	0,000	0,000	

DISCUSSION

Based on the analysis results, the research objectives were successfully achieved. The designed educational model effectively improved teachers’ knowledge fostered positive attitudes toward dental care, and enhanced toothbrushing skills among children with intellectual disabilities. The results of the repeated measures ANOVA test showed a significant increase between pre-test and post-test scores in both the intervention and control groups, with a significance value of $p < 0.05$. Teachers in the intervention group demonstrated better ability to model proper toothbrushing techniques, while children with intellectual disabilities exhibited improved motor skills and discipline in maintaining oral hygiene after the intervention.

From the perspective of each measured variable, the increase in knowledge reflects improved cognitive understanding of oral hygiene principles, including the importance of brushing techniques, frequency, and preventive care. Previous international studies have shown that structured oral health education significantly improves knowledge among caregivers and educators working with children with disabilities (e.g., studies in China, Europe, and the United

States)^(13, 17). The improvement in attitudes indicates a positive shift in teachers’ perceptions, motivation, and willingness to consistently guide children. This aligns with global evidence suggesting that positive attitudes among caregivers are a key determinant of successful health behavior interventions in children with intellectual disabilities^(18, 19). Meanwhile, the enhancement of skills demonstrates behavioral outcomes, particularly in the psychomotor domain, where children were able to imitate and perform toothbrushing movements more effectively^(20, 21). Research conducted in various countries has confirmed that repeated practice combined with guided instruction significantly improves adaptive self-care skills among children with intellectual disabilities.

These findings are consistent with the study by Sandjojo et al.⁽¹²⁾, which showed that hands-on training can improve the independence of individuals with intellectual disabilities in performing daily activities. Similarly, the study by Liu et al.⁽¹³⁾ on the *Impact of oral health behaviors on dental caries in children with intellectual disabilities in Guangzhou, China* supports this result. Theories of behavior modification and social learning also align with these findings, sug-

gesting that learning through observation, repetition, and positive reinforcement strengthens adaptive behaviors such as personal hygiene skills⁽⁷⁾. This explains why teacher involvement as behavioral models plays a critical role in shaping toothbrushing habits among children with intellectual disabilities. Furthermore, the results are supported by Social Learning Theory and Behavior Modification Theory, which emphasize that learning occurs through observation, imitation, repetition, and reinforcement. In the context of children with intellectual disabilities, these mechanisms are particularly relevant due to their reliance on concrete, structured, and repetitive learning experiences.

The learning characteristics of children with intellectual disabilities play a crucial role in explaining the effectiveness of the intervention. These children typically exhibit limitations in cognitive processing, short-term memory, attention span, and abstract reasoning, but they respond well to visual, repetitive, and hands-on learning approaches^(22, 23). International literature highlights that multisensory learning strategies—such as combining visual aids, demonstrations, and kinesthetic activities—are highly effective for this population⁽²⁴⁾. In this study, the use of visual media (posters and videos), direct demonstration, and repeated guided practice aligns with best practices in special education globally. Such approaches facilitate better retention, comprehension, and skill acquisition compared to purely verbal instruction.

The correlation between variables in this study revealed a strong and reciprocal relationship between knowledge, attitudes, and skills in applying the oral health education model for children with intellectual disabilities. Increased teacher knowledge after training directly contributed to more positive attitudes in guiding and teaching children proper toothbrushing techniques. Adequate knowledge enables teachers to understand the importance of oral hygiene and its impact on general health, thereby motivating them to teach correct practices⁽⁶⁾. Such positive attitudes were reflected in consistent, patient, and hands-on guidance, which ultimately improved the children's ability to perform self-care independently. These findings align with the *Health Belief Model*

and the *Theory of Planned Behavior*, which emphasize that healthy behaviors are influenced by individuals' knowledge and attitudes toward health-related actions^(17, 18). In this context, the positive relationship between teachers' knowledge and children's skills indicates a transformative effect, whereby the enhancement of teachers' cognitive and affective capacities can transfer adaptive behaviors to students through structured learning, repetition, and positive reinforcement. In this study, improved teacher cognition and affect translated into better instructional practices, ultimately enhancing children's behavioral outcomes. Similar findings have been reported in international studies emphasizing the role of caregiver education in improving health-related behaviors among children with special needs.

Although this study showed significant improvements in knowledge, attitudes, and toothbrushing skills of children with intellectual disabilities, the working mechanism of the oral health education model still needs to be explained in more detail. The implemented model combines a multisensory approach, including the use of visual media such as posters and videos, direct demonstrations, and repeated practice under teacher guidance^(23, 24). Positive reinforcement strategies, such as praise, rewards, and gradual repetition of skills, play an important role in increasing children's motivation and consistency in adaptive behaviors⁽²⁵⁻²⁷⁾. This approach aligns with the principles of special-needs education, which emphasize sensory involvement, reinforcement, and repetition to develop fine motor skills and daily self-care habits^(19, 20).

The data show that the intervention group experienced a faster and more significant improvement compared to the control group. This is likely due to the provision of structured education, the participatory approach of teachers serving as behavioral models, and direct practice sessions that were not fully provided to the control group⁽²⁸⁻³⁰⁾. Emphasizing this difference is important to demonstrate the relative effectiveness of the developed educational model.

This study makes an important contribution to the field of oral health education for children

with special needs. The developed educational model can serve as an alternative practical learning method in special schools^(31, 32). Furthermore, the study reinforces the concept that education-based health interventions can improve the independence of individuals with intellectual disabilities in maintaining personal hygiene⁽³³⁾. Practically, these findings can serve as a reference for teachers, school health personnel, and parents in designing learning activities that support children's oral and dental health.

The findings of this study may be generalized in a limited manner to settings with similar characteristics, particularly special education schools serving children with intellectual disabilities and involving active teacher facilitation. The developed oral health education model is relevant to special education environments with comparable instructional structures and learner characteristics⁽³⁴⁾. However, generalization should be interpreted cautiously due to variations in the severity of intellectual disability, sociocultural backgrounds, and differences in institutional resources and teacher competencies. Nevertheless, the core components of the model, visual learning, hands-on practice, repetition, and teacher-assisted guidance, are adaptive and have the potential to be applied in similar contexts with appropriate local adjustments.

Although this study demonstrates good effectiveness, it has several limitations. First, the small number of teachers and students limits the generalizability of the results to only two special schools in Jambi City. Second, the relatively short duration of the intervention (one month) may not reflect long-term behavioral changes. Third, skill assessments depended on direct observation, which could have been influenced by evaluator subjectivity. Therefore, further studies with broader scope, longer durations, and objective digital-based measurement tools are recommended to enhance the validity of the findings.

CONCLUSION

The oral health education model for children with intellectual disabilities in special schools is highly effective when implemented by teachers to enhance knowledge and attitudes

toward oral health maintenance and to improve toothbrushing skills among children with intellectual disabilities, provided it is conducted regularly and continuously.

Funding: This study did not receive any specific funding from public, commercial, or non-profit funding agencies.

Conflict of Interest: The authors declare that there are no conflicts of interest, either financial or non-financial, related to this study.

Acknowledgments: The authors would like to thank the State Special Schools (SLBN) in Jambi City for granting permission and support during the research process, as well as all teachers and students who participated in this study.

Author Contributions:

Hendry Boy: Conception and design study, model development, data collection, data analysis, and manuscript writing.

Muhammad Rusdi: Research design, statistical analysis, and critical review of the scientific content.

Solha Elrifda: Instruments validation, result interpretation, and methodological refinement.

Intan Lestari: Data analysis, results preparation, and final manuscript revision. All authors have read and approved the final version of the manuscript.

Artificial Intelligence Statement: In the development of this manuscript, the authors used ChatGPT (OpenAI, <https://chat.openai.com>) for language editing purposes only. The output generated by this tool was reviewed, validated, and edited by the authors, who take full responsibility for its content.

REFERENCES

1. Bashirian S, Khoshravesh S, Ayubi E, Amiri M, Karimi-Shahanjarini A, Barati M, et al. Predicting the oral health-related behaviors of the Iranian elderly based on the extended theory of planned behavior. BMC Oral Health [Internet]. 2025 [cited 2025 nov 12]; 25(1): 1137. Available from: <https://doi.org/10.1186/s12903-025-06180-2>
2. Rajeh MT. Modeling the theory of planned behavior to predict adults' intentions to improve oral health behaviors. BMC Public Health [Internet]. 2022 [cited 2025 nov 15]; 22(1): 1391. Available from: <https://doi.org/10.1186/s12903-022-06180-2>

- doi.org/10.1186/s12889-022-13796-4
3. Sabillillah MF, Kusnanto H, Hanindriyo L, Kuswandari S. Effect of oral health education model on tooth brushing behavior and oral hygiene among children with intellectual disabilities. *Brazilian Dent Sci* [Internet]. 2025 [cited 2025 nov 18]; 28(1): e4653. Available from: <https://doi.org/10.4322/bds.2025.e4653>
 4. Oliveira JS, Prado JRR, de Sousa LKR, de Oliveira AH, Moita NJM, Mendes RF. Intellectual disability and impact on oral health: a paired study. *Spec Care Dent* [Internet]. 2013 [cited 2025 nov 20]; 33(6): 262-8. Available from: <https://doi.org/10.1111/scd.12015>
 5. Lai YYL, Zafar S, Leonard HM, Walsh LJ, Downs JA. Oral health education and promotion in special needs children: systematic review and meta-analysis. *Oral Dis* [Internet]. 2022 [cited 2025 nov 23]; 28(1): 66-75. Available from: <https://doi.org/10.1111/odi.13731>
 6. Nurhuda GA, Sunarjo L, Fatmasari D, Sukini S, Ayun Q. Aprils Mophie Model Improves Toothbrushing Skills Of Intellectual Disabilities Children: Is It Effective? *J Kesehat Gigi* [Internet]. 2024 [cited 2025 nov 26]; 11(1): 33-40. Available from: <https://doi.org/10.31983/jkg.v11i1.10218>
 7. Michalski SC, Gallomario NC, Szpak A, May KW, Lee G, Ellison C, et al. Improving real-world skills in people with intellectual disabilities: an immersive virtual reality intervention. *Virtual Real* [Internet]. 2023 [cited 2025 nov 28]; 27(4): 3521-32. Available from: <https://doi.org/10.1007/s10055-023-00759-2>
 8. Cannella-Malone HI, Dueker SA, Barczak MA, Brock ME. Teaching academic skills to students with significant intellectual disabilities: a systematic review of the single-case design literature. *J Intellect Disabil* [Internet]. 2021 [cited 2025 dec 1]; 25(3): 387-404. Available from: <https://doi.org/10.1177/1744629519895387>
 9. Ningrum V, Wang WC, Liao HE, Bakar A, Shih YH. A special needs dentistry study of institutionalized individuals with intellectual disability in West Sumatra Indonesia. *Sci Rep* [Internet]. 2020 [cited 2025 dec 3]; 10(1): 1-8. Available from: <https://doi.org/10.1038/s41598-019-56865-2>
 10. Selbera LM, Boyd LD, Vineyard J, Smallidge DL. Impact of oral health education on the knowledge, behaviors, attitudes, and self-efficacy of caregivers for individuals with intellectual and developmental disabilities. *Am Dent Hyg Assoc* [Internet]. 2021 [cited 2025 dec 5]; 95(2): 21-7. Available from: <https://pubmed.ncbi.nlm.nih.gov/33875526/>
 11. Kangutkar T, Calache H, Watson J, Taylor S, Balandin S. Education/training interventions to improve oral health of adults with intellectual disability. *Healthcare (Basel)* [Internet]. 2022 [cited 2025 dec 7]; 10(10): 2061. Available from: <https://doi.org/10.3390/healthcare10102061>
 12. Sandjojo J, Zedlitz AMEE, Gebhardt WA, Hoekman J, den Haan JA, Evers AWM. Effects of self-management training for people with intellectual disabilities. *J Appl Res Intellect Disabil* [Internet]. 2019 [cited 2025 dec 9]; 32(2): 390-400. Available from: <https://doi.org/10.1111/jar.12536>
 13. Liu Z, Yu D, Luo W, Yang J, Lu J, Gao S, et al. Impact of oral health behaviors on dental caries in children with intellectual disabilities in Guangzhou, China. *Int J Environ Res Public Health* [Internet]. 2014 [cited 2025 dec 11]; 11(10): 11015-27. Available from: <https://doi.org/10.3390/ijerph111011015>
 14. Reynolds K, Chimoriya R, Chandio N, Tracey D, Pradhan A, Fahey P, et al. Effectiveness of sensory adaptive dental environments to reduce psychophysiology responses of dental anxiety and support positive behaviours in children and young adults with intellectual and developmental disabilities: a systematic review and meta-analysis. *BMC Oral Health* [Internet]. 2023 [cited 2025 dec 13]; 23(1): 769. Available from: <https://doi.org/10.1186/s12903-023-03445-6>
 15. Fickert NA, Ross D. Effectiveness of a caregiver education program on providing oral care to individuals with intellectual and developmental disabilities. *Intellect Dev Disabil* [Internet]. 2012 [cited 2025 dec 15]; 50(3): 219-32. Available from: <https://doi.org/10.1352/1934-9556-50.3.219>
 16. Wilson NJ, Lin Z, Villarosa A, Lewis P, Philip P, Sumar B, et al. Countering the poor oral health of people with intellectual and developmental disability: a scoping literature review. *BMC Public Health* [Internet]. 2019 [cited 2025 dec 17]; 19(1): 1530. Available from: <https://doi.org/10.1186/s12889-019-7863-1>
 17. Glassman P, Miller CE. Improving Oral Health for People With Special Needs Through Community-Based Dental Care Delivery. *J Calif Dent Assoc* [Internet]. 1998 [cited 2026 jun 4]; 26(5): 404-9. Available from: <https://pubmed.ncbi.nlm.nih.gov/10528576/>
 18. Petersen PE, Ogawa H. Strengthening the prevention of periodontal disease: the WHO approach. *J Periodontol* [Internet]. 2005 [cited 2026 jun 4]; 76(12): 2187-93. Available from: <https://doi.org/10.1902/jop.2005.76.12.2187>
 19. Mac Giolla Phadraig C, Guerin S, Nunn J. Should we educate care staff to improve the oral health and oral hygiene of people with intellectual disability in residential care? Real world lessons from a randomized controlled trial. *Spec Care Dent* [Internet]. 2015 [cited 2026 jun 4]; 35(3): 92-8.

- Available from: <https://doi.org/10.1111/scd.12102>
20. Abullais SS, Al-Shahrani FMF, Al-Gafel KMS, Saeed AHA, Al-Mathami SA, Bhavikatti SK, et al. The knowledge, attitude and practices of the caregivers about oral health care, at centers for intellectually disabled, in Southern region of Saudi Arabia [Internet]. In: Healthcare. MDPI; 2020 [cited 2026 jun 4]; p. 416. Available from: <https://doi.org/10.3390/healthcare8040416>
 21. Carr JE, Coriaty S, Wilder DA, Gaunt BT, Dozier CL, Britton LN, et al. A review of "noncontingent" reinforcement as treatment for the aberrant behavior of individuals with developmental disabilities. Res Dev Disabil [Internet]. 2000 [cited 2026 jun 4]; 21(5): 377-91. Available from: [https://doi.org/10.1016/s0891-4222\(00\)00050-0](https://doi.org/10.1016/s0891-4222(00)00050-0)
 22. Hallahan DE, Kauffman JM, Pullen PC. Exceptional learners: An introduction to special education: Pearson new international edition. Pearson Higher Ed [Internet]; 2013 [cited 2026 jun 4]. Available from: <https://doi.org/10.1093/acrefore/9780190264093.013.926>
 23. Shams L, Seitz AR. Benefits of multisensory learning. Trends Cogn Sci [Internet]. 2008 [cited 2026 jun 4]; 12(11): 411-7. Available from: <https://doi.org/10.1016/j.tics.2008.07.006>
 24. Cooper JO, Heron T, Heward WL. Applied behavior analysis. Pearson UK [Internet]; 2020 [cited 2026 jun 4]. Available from: https://www.pearson.com/en-us/subject-catalog/p/applied-behavior-analysis/P200000000905/9780137477210?srsltid=AfmBOoqK2TCqKk6rkjPf5Wfbh_QGLYq0Bli2RR4MjSapQVOzeOQ3Z9P-
 25. Aljameel AH, Gulzar S, Gupta M, Alshehri AA, Almalki SA, Asiri FY, et al. Oral Health Promotion among Individuals with Intellectual Disabilities: A Systematic Review. Eur J Dent [Internet]. 2024 [cited 2025 dec 19]; 18(1): 55-64. Available from: <https://doi.org/10.3390/nu15010055>
 26. Prihastuti R, Hinode D, Fukui M, Rodis OMM, Matsuka Y. Theory-based educational intervention on oral hygiene behavior among university students: a randomized controlled trial. BDJ Open [Internet]. 2025 [cited 2025 dec 21]; 11(1): 80. Available from: <https://doi.org/10.1038/s41405-025-00368-y>
 27. Kazdin AE. Behavior modification in applied settings. Waveland Press [Internet]; 2012 [cited 2026 jun 4]. Available from: <https://www.waveland.com/browse.php?t=369>
 28. Al-Jawaldeh A, Taktouk M, Naalbandian S, Aguenau H, Al Hamad N, Almamary S, et al. Sugar reduction initiatives in the eastern Mediterranean region: a systematic review. Nutrients [Internet]. 2022 [cited 2025 dec 23]; 15(1): 55. Available from: <https://doi.org/10.3390/nu15010055>
 29. Deshpande A, Bane P, Nuvvula S. Multi-sensory integration for strategic behavior guidance in pediatric dentistry: a narrative review. Contemp Pediatr [Internet]. 2022 [cited 2025 dec 27]; 3(2): 41-51. Available from: <https://doi.org/10.51463/cpd.2022.188>
 30. Browder DM, Wood L, Thompson J, Ribuffo C. Evidence-based practices for students with severe disabilities. Ceedar Doc NO IC-3 Ceedar Cent [Internet]. 2014 [cited 2026 jun 4]; Available from: <http://cedar.education.ufl.edu/tools/innovation-configurations/>
 31. Rachmadani F, Murtiningsih S, Maharani SD. The application of model thematic learning to building basic capability for children with special needs. JP (Jurnal Pendidikan) Teor dan Prakt [Internet]. 2020 [2026 jun 4]; 5(1). Available from: <https://doi.org/10.26740/jp.v5n1.p%25p>
 32. Arianti R, Sowiyah S, Handoko H, Rini R. Learning of children with special needs in inclusive schools. J Soc Res [Internet]. 2022 [2026 jun 4]; 2(1): 142-7. Available from: <https://doi.org/10.55324/josr.v2i1.474>
 33. Bridges SA, Robinson OP, Stewart EW, Kwon D, Mutua K. Augmented reality: Teaching daily living skills to adults with intellectual disabilities. J Spec Educ Technol [Internet]. 2020 [2026 jun 4]; 35(1): 3-14. Available from: <https://doi.org/10.1177/0162643419836411>
 34. Bhardwaj VK, Sharma KR, Luthra RP, Jhingta P, Sharma D, Justa A. Impact of school-based oral health education program on oral health of 12 and 15 years old school children. J Educ Health Promot [Internet]. 2013 [2026 jun 4]; 2(1): 33. Available from: <https://doi.org/10.4103/2277-9531.115820>

