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Effectiveness of Dental Joyful Learning Videos on Oral Health Knowledge in Children with Intellectual Disabilities in Paedagogia Special School in Surabaya

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ABSTRACT Children with intellectual disabilities often experience substantial challenges in understanding and performing effective oral hygiene practices, which contributes to a disproportionately high prevalence of dental caries and unmet dental treatment needs. Limited cognitive abilities, reduced motor skills, and low health literacy further hinder their ability to maintain proper oral hygiene. Addressing these gaps requires educational approaches that are accessible, engaging, and tailored to their learning characteristics. This study aimed to evaluate the effectiveness of the Dental Joyful Learning video a short animated educational intervention on improving oral health knowledge among students with intellectual disabilities at SLB Paedagogia Surabaya. A quasi-experimental design with a one-group pretest–posttest approach was employed involving 20 students who met the inclusion criteria. Participants completed a structured Guttman-scale questionnaire before and after a single 3-minute video intervention. Data were analyzed descriptively and statistically using the Wilcoxon signed-rank test to determine changes in knowledge. The findings demonstrated a marked improvement in oral health knowledge following the intervention. Prior to the video exposure, 75% of participants fell within the poor knowledge category, with an average score of 34%. After the intervention, 80% of participants reached the good category, with the mean score rising significantly to 83%. The Wilcoxon test yielded a p-value of 0.000 (<0.05), confirming a statistically significant increase in knowledge. In conclusion, the Dental Joyful Learning video proved effective in enhancing oral health knowledge among children with intellectual disabilities. The use of concise, visually engaging, and cognitively appropriate audiovisual media can serve as a practical and impactful educational strategy in special-needs settings. This study highlights the value of tailored digital health education tools in promoting better understanding and supporting preventive oral health behaviors in this vulnerable population.

INDEX TERMS Dental Joyful Learning, oral health knowledge, intellectual disability, audiovisual media, quasi-experimental study.

I. INTRODUCTION

Children with intellectual disabilities (ID) remain one of the most vulnerable populations regarding oral health outcomes. Despite global progress in preventive dentistry, numerous studies consistently report that children with ID experience higher rates of untreated dental caries, gingivitis, periodontal problems, and traumatic dental conditions compared to typically developing peers [1]–[4]. These disparities are further exacerbated by cognitive limitations, reduced motor coordination, difficulties in understanding instructions, and low adherence to oral hygiene routines [5], [6]. In Indonesia, the situation is similarly concerning, with national surveillance indicating a persistently high burden of dental caries and limited access to tailored oral health education for children with disabilities [7], [8]. This condition reflects a pressing public health challenge requiring effective, inclusive, and age-appropriate health promotion strategies.

Modern oral health education emphasizes the role of interactive and multisensory learning media as tools capable of improving comprehension and engagement among children with special needs. Current state-of-the-art interventions include animated educational videos, game-based learning, augmented visual aids, and digital storytelling, all of which have demonstrated positive outcomes in enhancing knowledge retention among children with cognitive limitations [9]–[12]. Video-based instruction, in particular, has been shown to provide superior attention, comprehension, and motivation due to its ability to translate abstract concepts (e.g., plaque formation or brushing techniques) into concrete visual demonstrations [13]–[15]. However, despite these advancements, the availability of digital oral health education tools specifically designed for children with ID remains limited in Indonesia.

A review of existing literature indicates a research gap in the development and evaluation of locally adapted, culturally relevant, and disability-friendly audiovisual media for oral hygiene education in special-needs school settings. Most previous studies primarily focus on general pediatric populations or caregivers, leaving children with ID underrepresented in intervention-based research [16]–[18]. In addition, few studies employ quasi-experimental approaches to measure the direct impact of audiovisual educational tools on knowledge improvement within this population. Therefore, empirical evidence regarding the

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Vol. 5 No. 6, pp. 276-281, December 2025

effectiveness of short, visually guided, and cognitively appropriate video-based media such as the Dental Joyful Learning video remains insufficient.

Addressing this gap, the present study aims to assess the effectiveness of the Dental Joyful Learning animated educational video in improving oral health knowledge among children with intellectual disabilities at SLB Paedagogia Surabaya. This study evaluates knowledge changes before and after exposure to a three-minute instructional video focusing on toothbrushing techniques, healthy dietary choices, and the importance of routine dental check-ups.The contributions of this article are threefold:

1. Providing empirical evidence on the impact of digital audiovisual learning media specifically adapted for children with ID;
2. Offering a disability-inclusive educational model that can be replicated in school-based oral health programs; and
3. Proposing a structured evaluation framework for assessing oral health knowledge improvement resulting from multimedia-based interventions.

II. METHODS

This study employed a quasi-experimental, single-group pretest–posttest design to evaluate the effectiveness of the *Dental Joyful Learning* animated video in enhancing oral health knowledge among children with intellectual disabilities (ID) enrolled at SLB Paedagogia Surabaya. The methods were structured to allow replication, with detailed specifications regarding the study design, setting, participants, intervention, instruments, procedures, and statistical analysis. The quasi-experimental approach was selected because randomization was not feasible within the special-school learning environment and because the entire accessible population met the inclusion criteria. This design is commonly used in educational and public health interventions involving vulnerable populations [31].

A. STUDY DESIGN AND SETTING

The study followed a prospective quasi-experimental design involving two structured measurements:

1. a pretest assessment (baseline),
2. delivery of a three-minute audiovisual intervention, and
3. a posttest assessment using the same instrument.

No control group was implemented due to ethical considerations and the limited population size. A single-group design is appropriate in studies targeting small or hard-to-reach populations, particularly those with disabilities [32]. The study period spanned January–April 2025 and adhered to the ethical protocol approved by the Ethics Committee of Poltekkes Kemenkes Surabaya.

The investigation was conducted at SLB Paedagogia Surabaya, located in Kaliasin I, Tegalsari District, Surabaya. The institution serves children with multiple disabilities, including ID, autism spectrum disorders, Down syndrome, and physical impairments. Classes at the institution are small (typically 4–8 students), which facilitated controlled delivery of the intervention.

B. POPULATION AND SAMPLING METHOD

The study population comprised all students diagnosed with intellectual disabilities who were attending school during the study period. A **total population sampling technique** was adopted because the available sample was limited and met all eligibility criteria. This method maximizes representativeness in small populations and is frequently recommended for educational research involving special-needs students [33]. The final sample consisted of **20 students**, aged 9–20 years, categorized according to the school's developmental grouping system.

Inclusion Criteria

1. Official diagnosis of intellectual disability documented by the school.
2. Ability to participate in guided learning activities.
3. Parental or guardian written consent.
4. Student assent through simplified verbal explanation.

Exclusion Criteria

1. Absence during either testing session.
2. Severe behavioral issues hindering participation.
3. Health conditions limiting the ability to watch or respond to the intervention.

C. INTERVENTION MATERIAL

The intervention consisted of an animated educational video Dental Joyful Learning lasting 3 minutes, designed and optimized for children with cognitive limitations. The video included:

1. Step-by-step toothbrushing techniques,
2. Recommended dietary patterns to prevent caries,
3. Importance of dental check-ups at least every six months.

Animated visual media have been widely demonstrated to improve attention, comprehension, and retention among children with disabilities due to multisensory stimulation and simplified representations [34], [35].

D. DATA COLLECTION INSTRUMENTS

Knowledge was measured using a structured dichotomous (Yes/No) Guttman-scale questionnaire, adapted from validated public-health education tools and adjusted linguistically for children with ID. Each correct answer was scored as 1, and incorrect answers as 0, yielding total knowledge scores that were converted into percentage categories:

1. Good (76–100%),
2. Moderate (56–75%),
3. Poor (≤56%).

Dichotomous scales offer advantages for disability populations because they minimize cognitive load and reduce interpretation errors [36]. The instrument underwent expert review for face validity by two dental health educators and one special education specialist.

E. DATA COLLECTION PROCEDURES

Data were collected in three sequential stages:

1. Pretest Administration

Students were assessed individually in a quiet classroom to minimize distractions. Researchers or teachers read each question aloud and clarified meaning using simple vocabulary and visual prompts when needed. No feedback was provided to prevent priming effects.

2. Intervention Delivery

Students were arranged in groups of 3–4 and shown the animated video on a laptop with external speakers. The standardized duration and delivery were maintained for every group. No additional verbal explanation was given to ensure that knowledge gains could be attributed solely to the multimedia intervention.

3. Posttest Administration

The posttest was conducted 15 minutes after the intervention using the same questionnaire. This interval was chosen to

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Vol. 5 No. 6, pp. 276-281, December 2025

assess immediate comprehension and recall, following common practice in short-term educational evaluation [37].

F. ETHICAL CONSIDERATIONS

Ethical approval was granted under protocol No.EA/3454./KEPK-Poltekkes_Sby/V/2025. Confidentiality was maintained through anonymized coding and secure data storage. Participation was voluntary, and guardians were informed about study procedures, potential benefits, and the right to withdraw at any time. Adjusted assent procedures were used to ensure comprehension among children with ID, as recommended in disability research ethics frameworks [40].

G. DATA PROCESSING AND STATISTICAL ANALYSIS

Data were coded numerically and analyzed using **IBM SPSS Statistics version 26**. Descriptive statistics (frequency, percentage, mean scores) were calculated for pretest and posttest knowledge levels. Because the data were ordinal and originated from paired observations, the **Wilcoxon Signed-Rank Test** was used to evaluate differences between pretest and posttest scores. The Wilcoxon test is recommended for nonparametric paired analyses in small educational samples and intervention studies involving non-normal distributions [38], [39]. A significance level of $\mathbf{p < 0.05}$ was applied.

III. RESULT

The Paedagogia Surabaya Special School (SLB)is a private school that was established in 1991 and is located on Kaliasin I Street, Kedungdoro, Tegalsari District, Surabaya City. SLB Paedagogia Surabaya is one of the schools for students with various types of disabilities, such as intellectual disabilities, autism, down syndrome, hearing impaired, mentally disabled, and physically disabled. The school is accredited B and strategically located in the center of Surabaya City, with nearby health facilities such as Kedungdoro Health Center and Ketabang Health Center.

TABLE 1
Characteristics of Respondents by Age Category and Gender in 2025

Characteristics	Respondents	N	%
Age	9-11 years old	7	35
	12-16 years old	9	45
	17-20 years old	4	20
Gender	Male	14	70
	Female	6	30

TABLE 2
Distribution of Pretest Results of Knowledge of Maintenance of Dental and Oral Hygiene in Tunagrahita Children at SLB Paedagogia Surabaya Before Educational Intervention Using Dental Joyful Learning Media 2025

Category	N	%
Poor	15	75
Moderate	5	25
Good	0	0
Total	20	100
Average		34

Referring to the data in TABLE 1, most of the students at SLB Paedagogia Surabaya who have intellectual disabilities are 9 students (45%) in the age range of 12-16 years, 7 students (35%) aged 9-11 years, and 4 students (20%) aged 17-20 years. Additionally, the characteristics of students with intellectual disabilities show a predominance of male respondents, with a total of 14 students (70%), and 6 female students (30%).

Based on TABLE 2, it was identified that the knowledge of oral health maintenance in children with disabilities at SLB Paedagogia Surabaya before the educational intervention using Joyful Learning video media was still very low, with 15 students (75%) in the poor category and 5 students (25%) in the good enough category, with an overall average of 34%.

TABLE 3
Distribution of Posttest Results of Knowledge of Maintenance of Dental and Oral Hygiene in Tunagrahita Children at Paedagogia Surabaya SLB after Educational Intervention Using Dental Joyful Learning Media 2025

Category	N	%
Poor	0	0
Moderate	4	20
Good	16	80
Total	20	100
Average		83

Based on the results listed in TABLE 3, it can be interpreted that the results of knowledge about maintaining oral hygiene in children with disabilities in SLB Paedagogia Surabaya after an educational intervention using Dental Joyful Learning video media obtained significant results in the good category, as many as 16 students (80%), and in the sufficient category, only 4 students (20%), with an overall average of 83%.

TABLE 4
Analysis of Pretest and Posttest Results of Knowledge of Maintenance of Dental and Oral Hygiene in Tunagrahita Children at SLB Paedagogia Surabaya Before and After Educational Intervention Using Dental Joyful Learning Media 2025

Variable	Category			%	*Asymp Sig.*
	Poor	Moderate	Good		
Pretest	15	5	0	34	0,000
Posttest	0	4	16	83	

Based on TABLE 4, the pretest and posttest results showed a change in knowledge levels from 34% in the low category to 83%. The Wilcoxon test analysis results showed an Asymp Sig (2-tailed) value of 0.000 (sig < 0.05). The conclusion regarding the educational intervention using the Dental Joyful Learning animated video medium is proven to be effective in improving knowledge about maintaining oral hygiene among children with disabilities at SLB Paedagogia Surabaya.

IV. DISCUSSION

A. INTERPRETATION OF RESULTS

The findings of this quasi-experimental study demonstrate that the Dental Joyful Learning animated video significantly improved oral health knowledge among children with intellectual disabilities (ID) at SLB Paedagogia Surabaya. The mean knowledge score increased from 34% (poor category) in the pretest to 83% (good category) following the intervention. The Wilcoxon Signed-Rank test yielded a p-value < 0.001, confirming a statistically significant effect of the animated intervention. This improvement indicates that short animated audiovisual media can serve as an effective learning modality for children with cognitive limitations.

The substantial improvement in the posttest suggests that the visual and auditory elements of the animated content played a crucial role in knowledge uptake. Children with ID often benefit from simplified, repetitive, and concrete instructional presentations due to challenges in executive functioning, working memory, and abstract reasoning. Visual cues, colorful animations, and step-by-step demonstrations

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Vol. 5 No. 6, pp. 276-281, December 2025

bridge the gap between conceptual understanding and practical health behaviors. This aligns with contemporary cognitive load theory, which suggests that reducing linguistic complexity and increasing visual scaffolding can enhance learning in students with cognitive impairments [41].

Furthermore, the high acceptability of the learning media suggests that audiovisual educational content can capture attention more effectively than traditional lecture-based oral health promotion. The interactive features of animation such as character movement, sound effects, and sequential demonstrations have been shown to strengthen conceptual understanding, especially in populations with short attention spans or sensory-processing difficulties. The increase in knowledge scores indicates that the design and presentation of the video were appropriate for the developmental characteristics of children with ID.

B. COMPARISON WITH SIMILAR STUDIES

The findings of the present study are consistent with prior research highlighting the effectiveness of audiovisual and animated media in improving oral hygiene knowledge among children with developmental disabilities. Several studies have reported similar trends, demonstrating that visual-based instruction leads to significant cognitive gains compared with traditional pedagogy.

For example, Liu et al. demonstrated that multisensory board-game learning significantly enhanced oral health knowledge and plaque reduction among individuals with intellectual disabilities, highlighting the importance of interactive visual learning formats for this population [32]. Similarly, Sabilah et al. reported that animated health-education videos significantly improved oral health knowledge and toothbrushing skills in children with intellectual disabilities, showing a parallel improvement trajectory with the current study's findings [35].

International studies also corroborate the importance of audiovisual content. A randomized controlled trial conducted in Turkey showed that children with cognitive disabilities exhibited substantial knowledge improvement after exposure to dental-health animated videos compared to printed educational materials [41]. Meanwhile, Ortega and Ortiz found that cognitively accessible animated videos improved comprehension and retention in children with ID by simplifying vocabulary and incorporating visual metaphors that strengthened memory [42].

The present findings also resonate with the broader literature on digital health education. Recent systematic reviews suggest that digital animations improve health literacy more effectively than static media across various child populations, including those with autism, Down syndrome, and developmental delays [43], [44]. The consistency of these results supports the hypothesis that audiovisual and animated interventions can effectively mitigate learning barriers inherent to cognitive disability.

However, some contrasting evidence suggests that comprehension gains may vary depending on the severity of intellectual impairment. A study by Mohammed and Ali found that children with severe cognitive impairments required repeated exposure to video-based instructions to achieve sustained learning outcomes, in contrast to children with moderate impairments who benefited immediately from single-session interventions [45]. This underscores the need to tailor intervention frequency and duration to the functional ability of the learner.

Despite such differences, the broader literature supports the conclusion that animated audiovisual education can serve as a powerful tool for improving oral health knowledge in children with intellectual disabilities. By combining auditory explanations with visual demonstrations, this approach aligns with the strengths-based learning profiles commonly observed among children with ID.

C. LIMITATIONS AND IMPLICATIONS

1. Limitations

While the study demonstrated clear improvements in knowledge following the intervention, several methodological and contextual limitations must be acknowledged.

First, the study employed a single-group design without a control group, limiting the ability to attribute improvements exclusively to the intervention. Although the pretest–posttest comparison provides strong indications of effectiveness, the absence of a comparative group prevents controlling for external influences such as teacher reinforcement or prior exposure to oral health content.

Second, the sample size was relatively small (n = 20) and drawn from a single special school, which may limit generalizability to broader populations of children with intellectual disabilities. Different school environments, instructional cultures, or caregiver involvement may produce different results.

Third, the questionnaire used a dichotomous Guttman scale, which simplifies responses but may not capture nuanced levels of knowledge or deeper conceptual understanding. While dichotomous scales reduce cognitive burden for children with ID, they constrain the depth of assessment.

Fourth, knowledge was measured immediately after the intervention. The study did not examine long-term retention or behavioral change, leaving open the question of whether the learning gains translate into improved brushing practices or sustainable oral hygiene behavior.

Fifth, as the video was shown only once, the study did not investigate whether repeated exposure produces stronger or more durable effects. Some evidence suggests that spaced repetition may significantly enhance learning in children with intellectual and developmental disabilities [46].

2. Implications for Practice

Despite these limitations, the findings offer several important implications for both educational practice and health promotion for children with disabilities.

First, the study supports the integration of short animated videos into oral health education programs in special schools. Such media can complement existing instructional methods and serve as an accessible tool for teachers and caregivers.

Second, the intervention highlights the potential of digital health literacy strategies for populations with limited cognitive capacity. By presenting complex oral health concepts through visualization, the method aligns with inclusive-education principles and can reduce educational gaps.

Third, health educators and dental practitioners can adopt audiovisual media as part of routine oral health promotion. Videos may be distributed to parents to reinforce education at home, increasing the likelihood of consistent practice in daily routines.

Fourth, the study suggests the need for future research focusing on multi-session interventions, behavioral observations, plaque index measurements, and follow-up assessments to determine long-term behavioral impact.

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Vol. 5 No. 6, pp. 276-281, December 2025

Fifth, incorporation of such educational media into national school-based oral health programs could support wider dissemination, particularly in underserved regions where access to dental professionals is limited.

V. CONCLUSION

The present study was designed to evaluate the effectiveness of the *Dental Joyful Learning* animated video in improving oral health knowledge among children with intellectual disabilities at SLB Paedagogia Surabaya. The primary aim of this research was to determine whether a short audiovisual educational intervention could significantly enhance students' understanding of essential oral hygiene practices. The findings clearly demonstrated a noteworthy improvement, with the mean knowledge score increasing from **34% (poor)** prior to the intervention to **83% (good)** afterward, and the Wilcoxon Signed-Rank test confirming statistical significance ($\mathbf{p < 0.001}$). These results indicate that concise, visually structured, and cognitively accessible learning media are highly effective in facilitating comprehension among children with intellectual disabilities, who often face barriers in processing verbal or abstract information. The substantial post-intervention gains underscore the suitability of animated instructional content for this population, as such media optimize attention, simplify complex concepts, and encourage multisensory engagement. Despite the promising outcomes, this study acknowledges limitations related to sample size, the absence of a control group, and the short-term measurement of knowledge. These constraints open opportunities for future research to extend the evaluation across multiple sessions, incorporate behavioral assessments such as plaque index reduction, and explore long-term retention of knowledge. Further studies involving larger and more diverse samples are also recommended to enhance generalizability and refine implementation strategies in various special education contexts. Overall, the findings support the integration of tailored digital health education tools into school-based oral health programs, providing a scalable and inclusive approach to improving dental hygiene literacy among children with intellectual disabilities.

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DATA AVAILABILITY

No external datasets were generated or analyzed. All data are available from the corresponding author upon reasonable request.

AUTHOR CONTRIBUTION

Syaima Istikhamah was responsible for formulating the research design, conducting data collection, and making significant contributions to the analysis and interpretation of results. Ratih Larasati contributed to the development of learning materials, supervised the implementation of educational interventions, and actively participated in the writing and refinement of the research manuscript. Imam Sarwo Edi contributed to data analysis and interpretation of findings, as well as providing substantive input in the writing process to improve the overall quality of the research. Ida Chairanna Mahirawatie played a role in the literature review team, coordinating data collection and refining the content of the final manuscript. All authors have thoroughly reviewed and approved the final version of the manuscript and are willing to take full responsibility for all aspects of the research to ensure the integrity and accuracy of this scientific work.

DECLARATIONS

ETHICAL APPROVAL

This study received approval from the Ethics Committee of Poltekkes Kemenkes Surabaya (Approval No. EA/3454./KEPK-Poltekkes_Sby/V/2025) and was conducted in accordance with institutional and international ethical guidelines. Participant confidentiality and voluntary participation were ensured throughout the study.

CONSENT FOR PUBLICATION PARTICIPANTS

Written informed consent was obtained from all parents or legal guardians, and verbal assent was acquired from participating students. All participants agreed to the publication of anonymized data.

COMPETING INTERESTS

The authors declare that there are no conflicts of interest related to this research.

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