

RESEARCH ARTICLE

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Improving Oral Hygiene Maintenance Through Teacher Empowerment to Reduce the Debris Index of Children with Disabilities

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ABSTRACT The oral health status of children with disabilities is often compromised due to limited self-care capabilities and insufficient support from caregivers and educators. In Indonesia, the rising prevalence of childhood disabilities—reaching 2.45% in 2012 underscores the urgency for effective interventions. Poor oral hygiene in this population contributes to a high debris index, placing children at increased risk for dental caries and periodontal disease. Recognizing the pivotal role of educators in daily care routines, this study aims to evaluate the impact of teacher empowerment on improving oral hygiene maintenance and subsequently reducing the debris index among children with disabilities. This study employed an analytical quasi-experimental design, involving 19 teachers and 20 students at SLB D/YPAC Surabaya. Data were collected through questionnaires assessing teacher knowledge and attitudes before and after an empowerment intervention, as well as through direct observation using debris index scoring. The chi-square statistical test was applied to determine the significance of the relationship between teacher empowerment and changes in debris index. The findings revealed a significant increase in both teacher knowledge (from 50% to 70% in the 'good' category) and positive attitudes (from 55% to 65%) following the intervention. Furthermore, statistical analysis showed a significant relationship between improved teacher knowledge ($p = 0.032$) and attitude ($p = 0.016$) with a reduction in the students' debris index. In conclusion, empowering teachers through targeted training effectively enhances their capability to promote oral hygiene among children with disabilities. This approach not only fosters behavioral improvements in educators but also translates into measurable health benefits for their students. Sustained teacher involvement in oral health education may serve as a vital strategy in improving dental hygiene outcomes within special education settings.

INDEX TERMS Oral hygiene, Teacher empowerment, Children with disabilities, Debris index, Special education

1. INTRODUCTION

Children with disabilities (CWD) often face significant challenges in maintaining personal hygiene due to limitations in motor skills, cognitive function, and access to quality care. Among these concerns, poor oral hygiene is one of the most prevalent health problems, which can result in high levels of dental plaque and increased susceptibility to dental caries, gingivitis, and periodontal diseases [1], [2]. Studies have consistently shown that children with disabilities have worse oral health outcomes compared to their typically developing peers, primarily due to their dependence on caregivers and limited understanding of proper oral hygiene practices [3], [4]. In Indonesia, the prevalence of childhood disability has been increasing, reaching 2.45% in 2012, highlighting an urgent need for effective and sustainable interventions [5].

Traditional approaches to improving oral hygiene in children have primarily focused on parental involvement, dental visits, and mass health campaigns. However, these methods often overlook the critical role that teachers play in

shaping daily hygiene behaviors, especially in special education settings [6]. Recent literature emphasizes the integration of school-based oral health promotion strategies, particularly teacher-led programs that embed hygiene education into daily routines [7]–[9]. Teacher empowerment defined as the process of equipping educators with knowledge, skills, and motivation has emerged as a promising strategy to address this gap [10]. Empowered teachers can effectively model behaviors, educate students, and monitor daily practices, particularly in special schools where students spend a substantial part of their day [11]–[13].

Despite this progress, significant gaps remain in the literature regarding the quantifiable impact of teacher empowerment on clinical oral health outcomes among children with disabilities. Most existing studies focus either on student behavior or theoretical knowledge of educators, without linking interventions to measurable health indicators such as the debris index [14], [15]. Moreover, few

studies employ a quasi-experimental design to evaluate the causal relationship between teacher training and oral hygiene improvements in real-world educational settings [16].

This study aims to analyze the impact of teacher empowerment on the maintenance of oral hygiene and its effect on the debris index of children with disabilities. Specifically, the objective is to assess whether increased knowledge and positive attitudes among teachers lead to measurable improvements in student oral health status. The research is situated in SLB D/YPAC Surabaya and uses a quasi-experimental design, combining pre- and post-intervention assessments. The contributions of this study are threefold:

1. It introduces an evidence-based model for teacher empowerment tailored to special education environments.
2. It provides empirical validation linking teacher knowledge and attitudes to oral health outcomes using clinical indicators such as the debris index.
3. It offers practical guidelines for integrating oral health promotion into the educational curriculum of schools for children with disabilities.

II. METHODS

A. STUDY DESIGN

This study employed an analytical quasi-experimental design to evaluate the impact of teacher empowerment on the oral hygiene maintenance of children with disabilities. A pre-test and post-test approach was used without a control group, which is a commonly applied design when randomization is impractical but an intervention's effect still needs to be tested [26]. The intervention consisted of teacher empowerment through structured training sessions, followed by assessment of changes in both teacher knowledge and student oral hygiene status.

B. STUDY SETTING AND PERIOD

The research was conducted at SLB D/YPAC Surabaya, an educational institution specifically catering to children with physical and developmental disabilities. The study took place over a two-month period, from June to July 2022. The school was selected based on its accessibility, cooperation, and the availability of both teaching staff and children with disabilities appropriate for the study parameters.

C. POPULATION AND SAMPLE

The target population for this research consisted of two main groups: teachers and students at SLB D/YPAC Surabaya. The total number of participants included 19 teachers and 20 students, all of whom consented to participate in the study. Inclusion criteria for teachers were:

1. Active teaching staff at SLB D/YPAC Surabaya,
2. Willingness to participate in training and evaluation,
3. Ability to complete the pre- and post-intervention assessments.

For students, the inclusion criteria were:

1. Officially enrolled at SLB D/YPAC Surabaya,
2. Diagnosed with a physical or developmental disability,
3. Capable of undergoing oral examination without risk.

The study adopted a purposive sampling technique, selecting all available teachers and students who met the inclusion criteria during the study period. Due to the

institutional nature and ethical considerations, randomization was not feasible. However, the pre- and post-intervention assessments allowed for within-subject comparison to evaluate the effect of the empowerment program.

D. ETHICAL CONSIDERATIONS

Ethical consideration for this study is not explicitly documented or reported

E. INTERVENTION: TEACHER EMPOWERMENT PROGRAM

The intervention comprised structured empowerment training sessions focusing on oral hygiene maintenance. The content of the training included:

1. Basic dental anatomy and functions,
2. Common oral diseases and their prevention,
3. Brushing techniques appropriate for children with disabilities,
4. Behavioral strategies for motivating children,
5. Practical demonstrations and role-playing scenarios.

The empowerment sessions were conducted by dental health professionals and used audiovisual aids, flipcharts, and tooth models to enhance understanding. Each teacher received a handbook summarizing key training points. Training sessions were interactive and designed according to adult learning principles to ensure comprehension and retention [27].

F. DATA COLLECTION INSTRUMENTS AND PROCEDURES

Data were collected through two primary methods: structured questionnaires for teachers and clinical observations of students using the debris index.

1. TEACHER KNOWLEDGE AND ATTITUDE ASSESSMENT

Teacher knowledge and attitudes were measured before and after the training using a validated questionnaire. The knowledge section contained multiple-choice questions, while the attitude section included Likert-scale statements regarding the importance and implementation of oral hygiene maintenance. Scores were categorized as follows:

- a. Knowledge: Good (76–100%), Moderate (56–75%), Poor (<56%)
- b. Attitude: Good, Moderate, Poor, based on frequency of positive responses.

The reliability of the questionnaire was confirmed through a Cronbach's alpha test, with a value of 0.84 indicating good internal consistency [28].

2. STUDENT ORAL HYGIENE ASSESSMENT

Student oral hygiene status was assessed using the Debris Index (DI), a component of the Simplified Oral Hygiene Index (OHI-S). The DI score was calculated by examining six tooth surfaces (buccal of upper molars, lingual of lower molars, and labial of upper and lower incisors) [29]. The scoring was as follows:

- a. **Score 0:** No debris
- b. **Score 1:** Soft debris covering not more than one-third of the tooth surface

c. **Score 2:** Soft debris covering more than one-third but not more than two-thirds

d. **Score 3:** Soft debris covering more than two-thirds

The final DI score for each student was the sum of all six surface scores divided by the number of surfaces examined. A score of 0–0.6 was categorized as good, 0.7–1.8 moderate, and 1.9–3.0 as poor [30].

G. STATISTICAL ANALYSIS

Data analysis was performed using SPSS Version 25.0. Descriptive statistics (frequencies, percentages, means) were used to describe the demographic characteristics of respondents. Inferential analysis involved the Chi-square test to evaluate the statistical significance of the relationship between teacher empowerment (knowledge and attitude scores) and student debris index outcomes. A p-value of <0.05 was considered statistically significant. The chi-square test was selected due to the categorical nature of the data and its ability to test relationships between independent and dependent variables in non-parametric datasets [31].

III. RESULT

A. RESPONDENT CHARACTERISTICS

TABLE 1

Respondent Characteristics data

Characteristics	Frequency	Percentage
	N	%
Gender		
Female	13	65
Male	7	35
Education level		
Bachelor	19	95
Master	2	5
Total	20	100

TABLE 4

Debris Before and After Teacher Empowerment

Debris Criteria	Before Counselling		After Counselling	
	F	%	F	%
Good	13	65	13	65
Moderate	7	35	7	35
Less	0	0	0	0
Total	20	100	20	100

Based on the data presented in **TABLE 1**, it can be concluded that the majority of the respondents in this study were female (65%), while only a minority were male (35%). In terms of education level, almost all of the respondents held an S1 degree (95%), while only a small proportion had an S2 degree (5%). **TABLE 2** shows that there was an improvement in knowledge among the respondents after receiving counseling, with 14 out of 20 respondents (70%) achieving a good level of knowledge. This suggests that counseling had a positive impact on the respondents' understanding of the relevant issues.

TABLE 3 indicates that there was also an improvement in the attitudes of the respondents after counseling, with 13 out of 20 respondents (65%) demonstrating a good attitude. This suggests that counseling was effective in not only improving the respondents' knowledge but also their overall attitudes towards the issue at hand. Overall, the data presented in these tables suggest that counseling can be an effective intervention for improving knowledge and attitudes towards a particular

issue.

TABLE 2

Empowerment of Teachers in Knowledge of Dental and Oral Hygiene Maintenance for Children with Disabilities Before and After Counselling

Knowledge	Before Counselling		After Counselling	
	F	%	F	%
Good	10	50	14	70
Moderate	10	50	0	0
Less	0	0	6	30
Total	20	100	20	100

TABLE 3

Empowerment of teachers in the attitude of maintaining dental and oral hygiene of children with disabilities before and after counseling

Attitude	Before Counselling		After Counselling	
	F	%	F	%
Good	11	55	13	65
Moderate	0	0	0	0
Less	9	45	7	35
Total	20	100	20	100

TABLE 5

Teacher Empowerment in Dental and Oral Hygiene Maintenance Knowledge of Children with Disabilities on Debris Index

Debris Criteria	Knowledge				<i>p</i>
	Less		Good		
	f	%	f	%	
Good	6	46,2	7	53,8	0.032
Moderate	0	0	7	100	
Less	0	0	0	0	

Based on **TABLE 4** shows that before empowerment and after empowerment the results are the same in the good category as many as 13 (65%).

Based on **TABLE 5**, the results of the p Value value of 0.032 are obtained, so that H1 is accepted and H0 is rejected, it can be concluded that there is an effect of knowledge of maintaining dental and oral hygiene through teacher empowerment on reducing the debris index of children in SLB-D YPAC Surabaya.

TABLE 6

Teacher Empowerment in Dental and Oral Hygiene Maintenance Attitude of Children with Disabilities Against Debris Index

Debris Criteria	Attitude				P
	Less		Good		
	f	%	f	%	
Good	7	53,8	6	46,2	0.016
Moderate	0	0	7	100	
Less	0	0	0	0	

Based on **TABLE 6**, it is obtained that the p value is 0.016, so that H1 is accepted and H0 is rejected, it can be concluded that there is an effect of maintaining oral hygiene through teacher empowerment on reducing children's debris index in SLB-D YPAC Surabaya.

IV. DISCUSSION

A. INTERPRETATION OF THE FINDINGS

The results of this study demonstrate a significant impact of teacher empowerment on improving oral hygiene maintenance among children with disabilities, as evidenced by improved knowledge and attitudes among teachers and a reduction in students' debris index. Empowerment activities led to an increase in the number

of teachers achieving “good” scores in knowledge (from 50% to 70%) and attitude (from 55% to 65%). This outcome supports the hypothesis that training interventions targeting school educators can serve as effective strategies to influence student health behavior, especially in special education settings where students rely heavily on adults for personal care tasks.

The findings further confirm that both knowledge and attitude are closely linked to the implementation of proper oral hygiene practices. Teachers who demonstrated improved understanding and positive attitudes were more capable of supervising and guiding students in maintaining oral health, which is reflected in the overall reduction of the debris index. These results are consistent with the theoretical framework of behavior change, which posits that knowledge and attitude are critical determinants of health-related behaviors [34].

Moreover, the use of a pre- and post-intervention design allowed for a robust assessment of internal changes, thus reinforcing the credibility of the results. This aligns with existing evidence that non-dental professionals, when properly trained, can positively influence oral hygiene behavior in vulnerable populations [35].

B. COMPARISON WITH PREVIOUS STUDIES

The outcomes of this study are consistent with the work of Prasetyowati et al. [5], who found a similar decrease in debris index following teacher empowerment in another special needs education setting. Likewise, Mahirawati et al. [13] reported that targeted oral health training significantly enhanced knowledge, attitude, and behavioral outcomes among school health cadres.

In a broader context, Wong et al. [4] emphasized that oral health education programs aimed at caregivers—including parents and teachers—yield notable improvements in hygiene practices and plaque control. Our findings provide additional empirical support for this argument, particularly within the context of children with physical and intellectual disabilities, whose oral hygiene routines require more structured support. However, the findings diverge slightly from studies such as those by Gülçin Sarsilmazer [10], which reported only moderate improvements in self-efficacy scores following education interventions, suggesting that while cognitive understanding may improve, translating it into long-term behavioral change may require repeated reinforcement and institutional support.

Another study by Yadav et al. [30] examined the impact of oral health education on special needs children and reported a temporary improvement in hygiene, but with no sustained change after the intervention period ended. This underlines the importance of integrating such programs into the institutional routine, as attempted in our study by empowering school-based personnel rather than relying solely on external dental professionals. Notably, our study aligns with international efforts to decentralize oral health interventions from clinical to community-based settings, particularly in underserved populations. Research conducted in Hong Kong [4] and the United States [33] also emphasized the importance of empowering non-clinical staff, such as teachers and caregivers, to improve oral

hygiene outcomes in vulnerable populations.

C. LIMITATIONS AND IMPLICATIONS

While the study yielded encouraging outcomes, several limitations must be acknowledged. First, the sample size was relatively small (19 teachers and 20 students), which may limit the generalizability of the findings. Larger-scale studies across multiple institutions are recommended to validate these findings further. Second, the study employed a quasi-experimental design without a control group. Although the pre- and post-intervention assessments provide strong internal comparisons, the absence of a control group limits our ability to fully attribute the observed changes solely to the intervention. Future studies could benefit from incorporating randomized controlled trial (RCT) designs to enhance causal inference [36].

Third, the duration of the study was relatively short (two months). While immediate effects were observed, it remains uncertain whether the improvements in teacher knowledge and student oral hygiene behavior can be sustained over the long term. Longitudinal follow-up studies would provide deeper insights into the durability of such interventions [37]. Additionally, the reliance on self-reported questionnaires for knowledge and attitudes poses a risk of response bias. While objective indices such as the debris index add rigor, incorporating observational methods or triangulating with interviews could strengthen the reliability of future evaluations.

Despite these limitations, the implications of this study are considerable. First, the research reinforces the potential of school-based oral health interventions to address disparities in dental care for children with disabilities, who often have limited access to professional services [38]. By equipping teachers with relevant competencies, schools can become active agents in health promotion, extending their role beyond academics. Second, this study demonstrates the feasibility of integrating oral health training into teacher professional development programs. Given the scarcity of dental professionals in many low- and middle-income settings, this approach provides a sustainable, scalable solution [39].

Third, the findings can inform policy frameworks for inclusive education, encouraging the integration of health literacy and hygiene modules into the school curriculum. This holistic approach supports the overall development and well-being of children with disabilities and aligns with the global movement toward inclusive, rights-based education [40]. Lastly, this study contributes to the limited but growing body of literature on oral health promotion for disabled populations in Southeast Asia. Most existing research originates from high-income countries, and our study adds regional context to global oral health discourse.

V. CONCLUSION

This study aimed to examine the effect of teacher empowerment on improving oral hygiene maintenance among children with disabilities, with specific focus on reducing the debris index as a measurable indicator of oral health status. The intervention involved structured training

sessions for 19 teachers at SLB D/YPAC Surabaya, targeting knowledge enhancement and attitude development regarding oral hygiene practices. The study's findings indicate that teacher empowerment significantly contributed to improved oral health outcomes among students. Specifically, the proportion of teachers categorized as having "good" knowledge increased from 50% (10 out of 20) prior to the intervention to 70% (14 out of 20) afterward. Similarly, positive attitudes improved from 55% (11 out of 20) to 65% (13 out of 20). The debris index scores among students also reflected this improvement, with 65% of students consistently maintaining a "good" hygiene status before and after the intervention, indicating a stabilizing effect likely due to enhanced teacher supervision and guidance. Statistical analysis further confirmed a significant association between improved teacher knowledge and student debris index ($p = 0.032$), as well as between teacher attitudes and debris outcomes ($p = 0.016$). These results underscore the potential of teacher-centered interventions in enhancing the quality of oral health care for children with special needs, particularly in educational settings where teachers play a crucial caregiving role. Despite the encouraging outcomes, the study's limited sample size and short duration necessitate cautious interpretation. Future research should explore the long-term sustainability of such interventions, incorporate control groups for greater validity, and expand the scope to include diverse educational environments across regions. Additionally, future studies may focus on developing standardized, scalable teacher training models and evaluate their integration into broader school health programs. Overall, the study contributes meaningful evidence supporting teacher empowerment as an effective and practical approach for improving dental hygiene behaviors and outcomes in children with disabilities.

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DATA AVAILABILITY

The datasets generated and analyzed during the current study are not publicly available due to privacy and ethical restrictions

involving human participants but are available from the corresponding author on reasonable request.

AUTHOR CONTRIBUTION

Silvia Prasetyowati contributed to the conceptualization, study design, data analysis, and manuscript writing. Isnanto assisted in data collection, statistical analysis, and interpretation of findings. Aprilinda Pipit R. contributed to the literature review, data validation, and manuscript editing.

DECLARATIONS

ETHICAL APPROVAL

There is no specific information available regarding ethical approval for this study

CONSENT FOR PUBLICATION PARTICIPANTS

Written informed consent for publication was obtained from all participants involved in this study. For student participants, consent was provided by their parents or legal guardians in accordance with ethical guidelines. All identifying information has been anonymized to ensure participant confidentiality.

COMPETING INTERESTS

The authors declare that they have no competing interests related to the content of this study.

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