Smart Audio Toothbrush With UV-filtered Toothpaste Dispenser to Improve Skills Brushing Teeth and Reducing Debris Index Blind Children

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Abstract:- Background: Blind children are children who tend to have low dental hygiene conditions. Children's behavior in maintaining dental hygiene influences the status of their dental hygiene. Because of their limitations, it is difficult for them to interpret what they should do. To overcome this, media is used as an educational tool, namely Ada's Toothbrush to improve teeth brushing skills and reduce the debris index of blind children. Objective: To produce a Smart Audio Toothbrush With Uv-filtered toothpaste dispenser (Ada's Toothbrush) model to improve teeth brushing skills and reduce debris index for visually impaired children. Method: Using Quantitative methods with pre-experiment research design (*one group pretest and post-test design*). With the sampling technique, the total sampling consisted of 30 blind children given intervention with the model Ada's Toothbrush for 10 days. Results: The results of expert validation of the Ada's Toothbrush model through validity testing using Aiken V show value hit $\geq$ 0.8 is declared very valid and uses a reliability test Interclass Correlation[b] 0.915[c], because (icc>0.80) it has high reliability. So Ada's Toothbrush model is feasible as an effort to improve the teeth-brushing skills of blind children. This model is proven effective and there was an increase in skill scores (p=0.000) of blind children on how to brush their teeth before and after the intervention, and effective in improving dental hygiene status by reducing the debris index (p=0.000) before and after the intervention. Conclusion: The development of Ada's Toothbrush model is effective in improving teeth brushing skills and reducing the debris index of blind children.

Keywords:- Ada's Toothbrush Model, Blind Children, Brushing Teeth.

I. INTRODUCTION

The government currently continues to strive to advance the health sector in Indonesia to this day. The main goal of health development is to achieve optimal health[1]. According to the World Health Organization (WHO) in 2018, global health indicators such as health status, life expectancy, and overall living standards are important indicators of global health. Oral health refers to the condition of the oral cavity, which is free from pain and disease such as mouth and throat cancer, mouth wound infections, periodontal (gum) disease, tooth decay, tooth loss, as well as other conditions that limit a person's ability to bite, bite, smile. , and talk. Therefore, maternal health becomes increasingly important in general health, marital health, and living standards[2].

The results of Basic Health Research (Riskesdas) in 2018 showed that for dental and oral health, the proportion of dental and oral problems in Indonesia reached 57.6%, but only 10.2% of the population received services from medical dental personnel. The biggest dental problem in this country is damaged/cavities/sick teeth, reaching 45.3%. Oral health is also a concern, with the majority of the population experiencing swollen gums and/or ulcers (abscesses) at 14%. Even so, only 2.8% of the population practices proper tooth brushing[3].

Overall body health cannot be separated from the health condition of a person's teeth and mouth. However, until now, there have not been many reports that provide data regarding the dental health status of people with disabilities (ABK), especially blind people. The Department of Health (Depkes) as the competent authority has also not issued a report regarding the condition of their dental health. Paying attention to dental and oral health is a major challenge in health care for blind individuals. However, the available information regarding dental and oral health prevention for blind people is still very limited in existing reference sources[4].

WHO estimates that the number of children with special needs (ABK) in Indonesia is around 7-10% of the total number of children in Indonesia. According to Susenas data in 2003, Salsabilillah et al in Ce et al (2021) in their ideas stated that of all children with special needs (ABK) in Indonesia, there were 679,048 children with special needs (ABK) of school age or around 21.42%[5]. According to research conducted by Achmad, et al., in Astuti, Hidayati, and Edi in 2021, "Blindness" is a form of physical disability that affects a person's visual abilities, where the individual cannot see their surroundings. Based on data from the 2012 National Socio-Economic Survey (SUSENAS), it was found that around 2.45% of the Indonesian population experienced disabilities, with the largest percentage, namely 29.63%, being cases of disabilities related to difficulty seeing or being blind (Ministry of Health of the Republic of Indonesia, 2014). The results of the 2015 Population Survey

(SUPAS) according to Wahyuni et al, in Astuti et al, (2021) also indicate that the total number of people experiencing visual impairment in Indonesia reached 6.36% of the total population.[6].

Limited vision can cause challenges in maintaining oral hygiene for individuals with visual impairments. Individuals with visual impairment have a higher risk of experiencing dental and oral health problems compared to those with normal vision. This limitation is one of the inhibiting factors for blind people in gaining knowledge about dental and oral health, which will ultimately influence their attitudes and actions in maintaining dental and oral hygiene.[7].

The results of Kindangen et al's research, which refers to the Marimbun study, show that the dental and oral health of blind children tends to be worse when compared to individuals with normal vision. The results of this study found that 41.9% of blind children had good knowledge about dental and oral health, while 58.1% had poor knowledge. In addition, data on examining the dental caries status of blind children using the DMF-T method showed that 19.4% had low caries status, while 80.6% had high caries status. Marimbun et al's research findings also show that there is a significant relationship between dental and oral health knowledge and health in blind children, and illustrate that their level of dental and oral health has still not reached the good category. Therefore, a special approach is needed that pays attention to the acceptance of blind children and appropriate methods in treatment and prevention efforts to improve their oral and dental health.[8].

As many as 19 million children under the age of 15, or about 1% of the total population in that age group, are blind. Elsman et al in Rusmiati et al, (2022), say that this presents challenges for parents and blind children in the development of various aspects of life, including aspects of health and independence. In this situation, children with visual impairments need to face their lives with different treatment from children without visual impairments. This treatment must have maximum impact so that blind children have the same opportunities as normal children in developing their potential[9].

Generally, dental and oral care for normal individuals does not face significant challenges. However, for children with special needs who experience physical, mental-intellectual, social, or emotional limitations that significantly affect their growth or development compared to children of the same age, brushing their teeth becomes an obstacle. One group of children with special needs who require special attention is blind children. The poor condition of the oral cavity in blind children is caused by lack of supervision in brushing teeth, other factors such as tooth brushing technique, motor skills, and lack of adequate assistance. Apart from that, limited visualization is also an obstacle to understanding and mastering dental and oral hygiene practice techniques[10].

In providing lessons about oral hygiene to blind children, dental health workers need a lot of patience and perseverance. Apart from that, relatively sufficient time and the use of supporting media are very important in the process of delivering education to blind people. Children who are blind generally have a better sense of touch and hearing than normal children. The use of audio-based media has proven to be more effective than braille-based media in providing education about dental and oral health. However, combining the two media will provide more optimal effectiveness[11].

Based on research conducted by Widjaya, Mardiati, and Aprianti in 2018, it was concluded that blind children have sensitive hearing. Therefore, in providing lessons about dental health, it is important to consider their hearing sensitivity. One effective method in this case is to use the Audio method. In educational efforts, it is important to choose learning media that suits the needs and conditions of blind children. A lack of knowledge about maintaining oral hygiene can cause difficulties and limitations in maintaining oral health. As a result, blind children have behaviors that pose a higher risk of having poor oral hygiene status compared to normal children. Tandra et al in Astuti et al (2021) emphasized that poor dental and oral hygiene status also increases the risk of dental caries in blind children when compared to normal children.[6].

Several theories are relevant to this research, especially in increasing knowledge that can change the lifestyle habits of blind children. Knowledge is a factor that shapes a person's behavior which can influence their health status[12]. According to the classic HL Bloom theory, according to Hendrik L. Blum (1974) in Irwan (2017), the population's health status is influenced by several factors such as the environment, behavior, genetics, and the results of medical services. Where these 4 factors determine the health status of the population[12][13].

Several previous studies and the statements above are in line with what the author has done in the managerial practice activities of dental and oral therapists in October 2023 at SLBN Jepara. In this activity, the researcher carried out a community service which found the results of pretest data on blind children at SDLB, SMPLB, and SMALB at SLBN Jepara which showed that the results of objective examinations for blind children at SLB Negeri Jepara had Debris results with good criteria of 12% (2 people), moderate criteria 47% (8 people) and poor criteria 41% (7 people). The average debris is 1.49 (moderate), so based on this percentage, the majority of blind children in Jepara State Special School still have debris in the medium category. In this study the author also examined dental caries using the DMF-T method which obtained data in the very low category 23.5% (4 people), low category 23.5% (4 people), medium category 29% (5 people), high category 18% (3 people) and very high category 6% (1 person). With an average DMF-T of 3.35 (medium), so based on this percentage, the majority of blind children in Jepara State Special School still have DMF-T in the medium category. The author found that of 17 students, only 43% could carry out the technique of brushing their teeth correctly and as many as 57% did not do it correctly. The author also found that blind children still have difficulty applying toothpaste with the appropriate dose and size due to their limitations.

With the above problem, by conducting a preliminary study and collecting information data at SLB Negri Semarang and SLB A Dria Adi, it was found that the problem currently being experienced by blind children is that the condition of the debris index of blind children tends to be worse because they cannot see the condition of their mouths, so from it requires the help of other people to find out the condition of his mouth. Their skills in brushing their teeth still need to be improved, some of them brush their teeth twice a day but choose the time to brush their teeth when taking a shower in the morning and taking a shower in the afternoon. It was also found that when blind children practice brushing their teeth at school, teachers still need to help blind children put toothpaste on their toothbrushes because they cannot see how much toothpaste should be poured so that it is not too much or too little.

To improve brushing skills and reduce debris index for blind children effectively, a modification was developed called Smart Audio Toothbrush With Uv-filtered Toothpaste Dispenser (Ada's Toothbrush). This study aims to test the effectiveness of Ada's Toothbrush technology in providing appropriate instructions regarding toothbrushing techniques to blind children, this model is equipped with a toothpaste dispenser that dispenses toothpaste automatically in the appropriate dose. The sensitivity of blind children lies in one of their senses, namely sensitivity to sound through their hearing. By carrying out an intervention using Ada's Toothbrush media, it is hoped that it will be effective in influencing the beliefs of blind children. Through behavioral control integrated with media with interactive audio features, it is hoped that Ada's Toothbrush can increase interest, concentration, understanding, and awareness, and help blind children change their intentions regarding brushing their teeth. This then results in positive changes in tooth brushing habits, increasing in tooth brushing skills which will ultimately have an impact on changes in dental health status and improving their dental hygiene status through reducing the debris index.

II. RESEARCH METHODS AND SAMPLE

The method used in this research is quantitative samples in this study 20 blind children from Semarang State SLB and 10 blind children from Dria Adi SLB.

III. RESULTS AND DISCUSSION

A. Validity Test
Validity tests were carried out using Aiken V to test the feasibility of the model so that model trials could be carried out.

Table 1 Validity Test Using Aiken V

No.	Test results	Interpretation	Follow-up
1	0.96	Very Valid	Accepted/used
2	0.96	Very Valid	Accepted/used
3	0.96	Very Valid	Accepted/used
4	0.88	Very Valid	Accepted/used
5	1.00	Very Valid	Accepted/used
6	0.96	Very Valid	Accepted/used
7	0.92	Very Valid	Accepted/used
8	1.00	Very Valid	Accepted/used
9	0.92	Very Valid	Accepted/used
10	1.00	Very Valid	Accepted/used

In Table 1, all of the 10 question items are in a state of V hit $> = 0.8$, and all of them are declared very valid.
Reliability Test

Table 2 Expert Validation Reliability Test using ICC

	Interclass Correlation b	Sig
Single Measure	0.607[a]	0,000
Average Measure	0.915[c]	0,000

In Table 2, the results of the expert validation reliability test on one expert have an Interclass Correlation value of 0.607. Because the value is >0.50, the reliability has adequate stability, and overall the 6 experts have an Interclass Correlation[b] value of 0.915[c] because a value >0.80 can be interpreted as having high reliability.

B. Univariate Analysis
The model trial in this research was carried out on 30 blind children consisting of 20 students from SLB Negeri Semarang and 10 students from SLB A Dria Adi. A general description of respondents is presented in the following table:

C. Bivariate Analysis
Bivariate analysis is used to test the differences between two variables. In the initial stage, model testing is carried out by carrying out a normality test first and then testing the effectiveness of paired and unpaired variables.

➢ *Normality test*
The normality test is a test carried out to determine whether the data collected on each variable is normally distributed or not. This test uses the Shapiro-Wilk method because the number of samples in this study is less than 50 samples.

Table 3 Normality Test of Pre-Post Test Data for Blind Children's Skills

Variable	Intervention	Interpretation
Pre-Test Skills	0.002	Abnormal
Post-Test Skills	0,000	Abnormal
Pre-Test Debris Index	0.002	Abnormal
Post-Test Debris Index	0.004	Abnormal

*Shapiro-wilk

Based on Table 3, the results of the normality test show that pre-post knowledge, pre-post attitudes, pre-post actions, and pre-post Debris Index are not normally distributed.

because $p<0.05$. With data that is not normally distributed, the test that will be carried out is a non-parametric test, namely using the T-test *Wilcoxon* for paired tests.

➤ *Effectiveness Test*
The effectiveness test is a test carried out to determine the hypothesis test in this research which is explained in the following table:

Table 4 Test of the Effectiveness of Improving the Actions of Blind Children in Brushing Teeth

Statistics			
Variable	Mean±SD Pre-test	Mean±SD Post-test	*p*
Action	7.73 ± 0.868	13.90 ± 1.062	0,000*

Paired test: Wilcoxon

Based on Table 6, the results of the effectiveness test of unpaired pre-test data on attitude variables with an average value of pre-test results from 7.73 to 13.90. This means that there was an increase between the pre-post test and the actions of blind children.

The results of the effectiveness test of paired data on the action variables of blind children show that the p-value is 0.000 ($p<0.05$), meaning that Ada's Toothbrush model is effective in improving the actions of blind children.

Table 5 Testing the Effectiveness of Changing Dental Hygiene Status through Reducing Debris Index in Blind Children

Statistics			
Variable	Mean±SD Pre-test	Mean±SD Post-test	*p*
Debris Index	1.157 ± 0.4768	0.417 ± 0.3384	0,000*

* *Paired test: Wilcoxon*

Based on Table 7, the results of the effectiveness test of unpaired pre-test data on attitude variables with an average value of pre-test results from 1.157 to 0.417. This means that there was a decrease in the pre-post-test debris index for blind children.

The results of the effectiveness test for paired data on the debris index variable for blind children show that the p-value is 0.000 ($p<0.05$), meaning that Ada's Toothbrush model is effective in reducing the debris index for blind children.

IV. DISCUSSION

➤ *Model Testing*
The trials in this research were carried out on 30 blind children using Ada's Toothbrush model to improve the teeth brushing skills of blind children. The following is a description of the tests that researchers have carried out:

➤ *Action (Skills) Test for Blind Children*
Action tests were carried out to see how blind children's skills in brushing their teeth improved. In this study, there was an increase in the actions of blind children's

teeth brushing skills as proven through statistical tests of paired data. The average value of the actions of blind children in brushing their teeth before the intervention was 7.73 and after the intervention increased to 13.90 which shows the p-value. is 0.000 ($p<0.05$) which means that Ada's Toothbrush model is effective in improving the actions of blind children through brushing their teeth.

The increase occurred because Ada's Toothbrush media model has many advantages, namely, there is a stimulus that provokes children's minds, thus creating an attraction with the technological creativity provided, which makes children interested in understanding the skill of brushing their teeth. The Ada's Toothbrush media model intervention takes advantage of one of the advantages of blind children, namely their sense of hearing. One by one, children practice brushing their teeth properly and correctly after eating/snacking during break times. This is to the theory of behavior change through Stimulus Organism Response (SOR), which states that changes in behavior depend on the stimulus or stimuli given.

Brushing teeth is also carried out directly from days 1-10 (2 weeks). The practice of brushing teeth is carried out in the classroom and accompanied by the teacher. In the second week, the child begins to show changes in the way he brushes his teeth. If the child brushes their teeth repeatedly, the child will get used to doing it, with direct practice it will be easier for the child to apply the message conveyed.

➤ *Debris Index Test for Blind Children*

The debris index test for blind children was carried out to see whether there was an increase in the level of dental and oral hygiene through a decrease in the debris index score. In this study, the results of the effectiveness test of paired data found that the average debris index value for blind children before the intervention was 1.1, and after the intervention had increased to 0.4. This shows that the p-value is 0.000 ($p<0.05$) which means that Ada's Toothbrush model is effective in reducing the debris index for blind children.

The intelligence abilities of blind children and normal children are almost the same. The level of action ability of blind children's teeth brushing skills will affect the oral hygiene of blind children. Through Ada's Toothbrush model intervention, the debris index scores of blind children have decreased because respondents have been taught to understand good and correct teeth brushing practices and there has also been an increase in the teeth brushing skills of blind children.

The Ada's Toothbrush media model was declared successful in improving the teeth brushing skills of blind children by improving the teeth brushing habits of blind children. This can be seen because after the 10 days ended, blind children became more active in brushing their teeth twice a day according to the knowledge provided. Blind children are also able to brush their teeth properly and correctly so that the debris index number decreases.

The success of Ada's Toothbrush media model is due to the implementation having been carried out for 10 days, providing a lot of stimulus in the learning process by involving teachers in guiding and accompanying children in carrying out tooth brushing skills at school and also implementing at home because, during the intervention, blind children were given a tooth brushing calendar. to monitor children when brushing their teeth at home.

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