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Educational Model Puzzle Modio (Audio Modification) based on Gamification as an Effort to Reduce Debris Index in Down Syndrome Children

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Abstract:- Down syndrome is children who have intellectual deficiencies, so they have less behavior in self-care including brushing their teeth, as a result they have poor dental hygiene. To overcome this, media is used as a tool for delivery, one of which is the development of the Puzzle Modio (Audio Modification) to reduce debris index of Down syndrome children. The method used in this research is Research and Development (R&D) with 5 stages of research, model design, expert validation and revision, model/product trials and model/product results. The quasi-experimental design used is a pretest-posttest with a control group design. The sampling technique with purposive sampling, consisted of 12 children of the intervention group and 12 children of the control group, with the duration of treatment given for 21 days. The results of the validity and reliability of the Modio Puzzle (Audio Modification) showed values of 0.91 and 0.634, which means that this model is feasible as a learning medium to reduce index debris in Down syndrome children and Also this model is more effective in reducing the index debris score (p = 0.001) with an average difference value of 0.85 compared to the control group which was only 0.43. The development of Puzzle Modio (Audio Modification) based gamification is effective in efforts to improve toothbrushing skills in Down syndrome children.

Keywords:- *Puzzle Modio (Audio Modification), Down Syndrome Children, Debris Index.*

I. INTRODUCTION

Dental and oral health must be considered in addition to general health, because it affects the health of the whole body.Dental and oral health is important for everyone, including children, because untreated teeth and gums can lead to tooth and gum disease that causes pain. If children have problems with their dental and oral health, their quality of life will be disrupted, even though children are the nation's assets for future development.[1], [2]

According to the 2016 Global Burden of Disease Study, oral diseases affect at least 3.58 billion people worldwide, with permanent dental caries being the most common. It is estimated that 2.4 billion people worldwide suffer from permanent tooth caries and 486 million children suffer from primary tooth caries.[3]The 11th most common disease in the world is gum (periodontal) disease. Meanwhile, in Asia Pacific, oral cancer is the 3rd type of cancer suffered the most.[4]

The results of Basic Health Research (RISKESDAS) in 2018 show that the largest proportion of dental health problems in Indonesia are cavities at 45.3%, teeth lost due to extraction at 19%, loose teeth at 10.4%, and teeth that have been filled due to cavities. by 4.1%. Meanwhile, the oral health problems experienced by the majority of the Indonesian population are swollen gums or ulcers (abscesses) at 14%, then gums that bleed easily at 13.9%, canker sores recur at least 4 times at 8%, and canker sores persist and never heal at least 1 month by 0.9%.[4]

Dental and oral health problems not only occur in children with normal conditions, but also in children with special needs (ABK). The level of oral health in children with special needs is still quite low, with a caries prevalence of 92.71%. The results of research conducted by Pathak in Nepal also showed that the prevalence of dental caries was quite high at 75.9% and the dental and oral hygiene status of children with special needs was considered poor with only 8.8% of children having good dental and oral hygiene status.Research was also conducted by Dheepthasri in Madurai, India, with the results that among 133 subjects (children with special needs), only 3% had good oral hygiene.[5]–[7]

Children with special needs (ABK) are children with special characteristics that are different from children in general, such as mental, emotional, or physical disabilities. The term child with special needs is the most recently used term and is a translation of child with special needs. The use of the term special needs children has a different perspective from the term extraordinary children. If the term extraordinary refers more to the condition (physical, mental, emotional-social) of the child, it is different from the term special needs which refers more to the child's need to achieve according to his abilities.[8]

Dental health problems in children with special needs that are often encountered are very poor dental and oral hygiene, large amounts of soft and hard deposits on the teeth, periodontitis, a high percentage of untreated dental caries, a low number of filled teeth, higher number of

extracted teeth. rather than healthy teeth, dental and oral damage (from falls) and injuries occur frequently, and the prevalence of malocclusions of varying degrees of difficulty is high. Dental and oral health problems are often related to mental abilities and awareness of one's incompetence.[9]

Children with special needs can be classified into several categories based on their disorders or abnormalities, one of which is Down syndrome. Down syndrome is a type of ABK that is caused by abnormalities in chromosome 21, but because the chromosomes cannot separate during the meiosis process, resulting in 47 chromosomes. This addition of chromosome 21 is also called a partial extra.[10]Down syndrome can also be referred to as a disorder characterized by intellectual disability, or it can also be referred to as a mental disorder characterized by below-average mental health and intelligence, craniofacial abnormalities, cardiovascular disorders, and immune deficiencies.[11]

Based on data from the United States Centers for Disease Control and Prevention, 1 in 700 babies born have Down syndrome. Meanwhile, in the world, the incidence of Down syndrome is around 1 in 1000 babies.[12]Every year, around 3000 to 5000 children are born with this condition. The World Health Organization (WHO) estimates that there are 8 million people with Down syndrome worldwide. According to Basic Health Research (RISKESDAS), Down syndrome cases in Indonesia had a value of 0.12% in 2010 and there was an increase of 0.13% in 2013 and increased again to 0.21% in 2018.[13]

Conditions that need to be considered in children with Down syndrome are hypotonus or weak muscle tone, which can affect difficulty in carrying out manual movements with dexterity, including maintaining personal hygiene. As a result, children often have poor oral and dental hygiene.[14]Down syndrome children are often found to have poor dental and oral hygiene due to inability or lack of self-awareness. They need help from family members, namely parents, caregivers, and people around them, including teachers, to help maintain healthy teeth, but family members and teachers still pay little attention to the importance of maintaining oral hygiene.[15]

The above conditions can cause various systemic diseases, such as poor dental and oral hygiene which can cause caries and gingivitis, bacteria that accumulate in the mouth, both of which can cause tooth decay and even tooth loss. If poor dental and oral hygiene is allowed, over time it can cause the spread of bacteria, and infections will occur throughout the body and reduce the quality of life.[15]

Efforts to treat teeth for Down syndrome sufferers are carried out by Schmidt in Germany, in collaboration with the German Down Syndrome Association. The research was carried out by providing questionnaires regarding tooth brushing behavior, oral health care at home, use of fluoride at home, and use of dental health services (dentist). Additionally, this study provides information on home oral health care through parents/caregivers and the use of dental health services and supportive oral hygiene interventions (e.g. advice, demonstration, and procedural trainingon oral hygiene). The results showed that two-thirds of the parents surveyed had started helping their children brush their teeth regularly.[16]

Efforts to overcome dental health problems and prevent dental and oral diseases in school-aged children and those with special needs have also been carried out by the Indonesian government through dental and oral health activities in schools through the School Dental Health Business (UKGS) program. Health services in the UKGS program include promotive, preventive, and curative efforts carried out in the school environment for students.[17]The UKGS program and dental and oral health service programs launched by the Indonesian and international governments have not produced results, it has been proven that no country is free from dental caries.[18]This was proven by Taftazani who showed that the number of SD/MI that received the UKGS program, promotive services carried out once a quarter were 80% and preventive 50%, this figure had not reached the target set by the government, namely promotive 100% and preventive 80%.[19]

Based on the background above, it can be concluded that dental and oral problems experienced by children with Down syndrome are caused by weak muscles, as well as by inability and lack of self-awareness in efforts to maintain dental and oral health, resulting in children having poor dental and oral hygiene. Therefore, there needs to be a change in maintaining dental and oral health by providing dental health education. By the characteristics of children with Down syndrome, dental health education should use learning methods that are interesting and enjoyable.

One method that can be used is learning with gamification. Gamification in the world of education is termed as the process of changing existing activities or learning activities and making the content like a game. Gamification can also be referred to as the process of problem-solving and uses thinking and game mechanics to engage users in a motivating way.[20]

One of the media that can be used in a learning method is puzzle modio (audio modification), which is a medium for putting together image fragments and then arranging them to form stages of brushing teeth, then there is audio and uses batteries. This audio is a sensor that can display audio related to the description or explanation of each stage of brushing teeth in the modio puzzle.

This modio puzzle model (audio modification) will provide learning carried out by children with Down syndrome and accompanied by teachers, because according to Husin, children with Down syndrome have limitations andless independence, so they need teacher assistance in the education process.[21]The implementation stage of this model has a sequence of teacher counseling, demonstration of the learning media model, tooth brushing practice, and evaluation.

II. MATERIALS AND METHODS

The research method used is Research and Development (R&D). This research aims to create a dental and oral health learning model through the development of a gamification-based puzzle modio (audio modification) educational model. This research used children with Down syndrome as subjects who were registered as students in grades 9-12 at SLB N Semarang and SLB N Ungaran. The sample for the product/model testing phase consisted of 24 children with Down syndrome, consisting of 12 children in the intervention group and 12 children in the group following the research process above, children whose data analysis was controlled by inclusion criteria were children aged 16 years who were cooperative and willing to perform with bivariate.

III. RESULTS AND DISCUSSION

A. Bivariate analysis

Bivariate analysis was carried out to test the differences between two variables, carried out by testing the effectiveness of paired variables and unpaired variables.

➢ *Homogeneity Test*

The homogeneity test aims to test whether the data comes from the same population. The method used for homogeneity testing is levene statistics. Data is homogeneous if the significance value is >0.05.

Table 1: Homogeneity Test

Homogeneity Test		
Variable	***Levene Statistics***	***p-Value***
Down Syndrome Children		
Debris Index	5,036	0.035

**Levene Statistics*

Based on the table above, shows the homogeneity test on the debris index variable for the intervention group and the control group with a p-value of 0.035 (<0.05), meaning that it can be concluded that the debris index for the intervention group and the control group have unequal variants (not homogeneous).

➢ *Normality test*

The data normality test aims to determine whether the data collected on each variable is normally or not normally distributed. Normality testing in this study used the Shapiro-Wilk method because the number of samples in this study was less than 50 samples.

Table 2: Normality Test

Variable	***p-Value***	
	Intervention	**Control**
Debris Index Pretest	**0.273**	**0.097**
Debris Index Posttest	**0.072**	**0.069**

*Shapiro-Wilk

Based on the table above,shows that the normality test results for the debris index variable for the intervention group and control group mostly have a p-value >0.05, meaning that the data is normally distributed, so it is continued with parametric tests.

➢ *Effectiveness Test*

Test the effectiveness of the gamification-based Puzzle Modio (Audio Modification) educational model using a paired test. In the paired test, normally distributed data is tested using the Paired t-test. In the unpaired test, normally distributed data was tested using the Independent t-test.

Table 3: Effectiveness Test of Paired and Unpaired Data Debris Index for Intervention Group and Control Group

Statistics						
Variable	**Group**	**Mean ± SD Pretest**	**Mean ± SD Posttest**	**Delta (Δ)**	***p-Value***	
Debris Index	Intervention	1.747 ± 0.555	0.900±0.388	0.85	0,000*	0.001**
	Control	1.947 ± 0.271	1.524 ± 0.411	0.43	0,000*	
Paired T-Test Independent T-Test*						

Based on the table above, shows the results of the paired debris index data test using parametric tests. The results in the intervention group were a p-value of 0.000 and in the control group were p-value of 0.000, this shows that the p-value <0.05, so it can be concluded that there is a difference before and after treatment. The results of the unpaired test on the debris index variable showed a p-value of 0.001 (<0.05), which means that there was a comparison of the debris index after treatment was given to the intervention group and the control group. There was an increase before and after being given treatment which can be seen from the average difference for each group, where the intervention group experienced an increase of 0.85 and the control group only 0.43. It can be said that the Modio puzzle (audio modification) can reduce the debris index of children with Down syndrome more than Widi's 3D Gosgi-modified puzzle.

➢ *Modio Puzzle Model Feasibility Test*

Dental health education is a planned and directed effort to create an atmosphere for individuals or groups to change their behavior for the better. Factors that can influence the success of counseling or delivering education are the media or tools used, the material presented, and the method for conveying the message.[22]Based on the results of previous research, it is stated that the use of media in repeated counseling can strengthen understanding of the material presented.[23]A person will more easily understand the content of the material if the media used uses more than one sense, namely sight and hearing.[22]

After being given treatment and trained to brush their teeth for 21 days at school accompanied by a teacher, the children began to understand and be able to practice brushing their teeth, because in this study the respondents were children with Down syndrome who were able to be taught and trained. The act of brushing teeth in children with Down syndrome has increased because puzzle modio (audio modification) has the advantage of involving the senses of sight and hearing, and uses a game mechanism that can be repeated. This is in line with previous research, that audio-visual media is more effective than visual media, because audio-visual media can provide a more real experience than audio or visual media alone, understanding of the information provided more quickly. After all, students not only listen but see directly, it's not just wishful thinking, and also audio-visual media is more interesting and fun.[24]

The gamification-based modio (audio modification) puzzle educational model is a medium that combines audio, visual, and gamification and can be used in the educational process of dental health education which is designed in an interesting, simple way, can convey information, teach skills and influence attitudes and children can be directly involved in it. its implementation. This is in line with previous research which shows that audio-visual media is an effective mediumused to convey learning information, so that it can improve children's skills in brushing their teeth.[25]

Based on the characteristics of children with Down syndrome, they cannot carry out independent activities, including brushing their teeth, therefore they need help from parents/teachers in the learning process. The teacher is considered the person closest to the child at school and someone who is an expert in providing educational interventions to children so that they can improve the child's skills. In practice, teachers need to be trained first to be able to transfer knowledge and transfer skills to children. According to Santoso's research, providing dental health education to children with special needs is not much different from normal children, but requires the role of parents/teachers in the implementation process.[26]

➢ *Effectiveness Test in Down Syndrome Children*

The model trial in this study was carried out on 24 people who were divided into 2 groups, namely 12 people in the intervention group and 12 people in the control group. The intervention group was given treatment using the Modio puzzle (audio modification) while the control group used Widi's 3D Gosgi-modification puzzle. The model applied to the intervention and control groups was carried out to reduce the debris index in children with Down syndrome.

The characteristics of Down syndrome children are characterized by their inability to adapt to their surrounding environment. From these characteristics, it can be concluded that children with Down syndrome cannot carry out activities independently, including brushing their teeth. Dental health problems that are often experienced by children with Down syndrome are poor oral hygiene, cavities, and tartar. To overcome this problem, an educational model was developed in the form of a modio puzzle (audio modification) which was carried out on children with Down syndrome as a learning medium to reduce index debris.

➢ *Effectiveness Test of Differences in Debris Index for Intervention Group and Control Group*

Results of the effectiveness test of paired debris index data for children with Down syndrome with a p-value in the intervention group of 0.000 ($p<0.05$) and the control group of 0.000 ($p<0.05$), which means puzzle modio (audio modification) and Widi's puzzle 3D modification gosgi makes a difference in reducing the debris index in children with Down syndrome. From the average difference value, there was an increase before and after treatment, where the intervention group experienced an increase of 0.85, which means that the gamification-based puzzle modio (audio modification) was effective in reducing the debris index in children with Down syndrome. Based on previous research, the debris index number will decrease if respondents apply good and correct tooth brushing methods.[27]A child's ability to brush their teeth properly and correctly is a very important factor in maintaining oral hygiene.

The gamification-based modio (audio modification) puzzle educational model was declared successful in reducing the debris index in children with Down syndrome because it was seen that after 21 days, the children were able act like brushing their teeth properly and correctly. The success of the modio puzzle media (audio modification) is due to the implementation of 21 days in the learning process by involving teachers in guiding and accompanying children in carrying out teeth brushing skills. Children with Down syndrome can practice brushing their teeth by teaching them repeatedly and with direct instructions.

This is in line with the advantages of the modio puzzle (audio modification), namely that it can be used repeatedly and in its implementation, there is a simulation.

➢ *Comparative Effectiveness Test of Differences in Debris Index Between the Intervention Group and the Control Group*

The unpaired effectiveness test of the debris index in children with Down syndrome showed a p-value of 0.001 ($p<0.05$) which shows that there is a difference in the debris index after being given treatment and seen from the average difference value in the intervention group of 0.85 while in the control group only 0.43 which shows that the modio puzzle (audio modification) is more effective in reducing the debris index compared to widi's puzzle 3D gosgi

modification.

The debris index number will decrease if respondents apply good and correct tooth brushing methods.[28]The success of brushing your teeth is also influenced by the use of tools, the frequency of brushing your teeth, and the right time and method for brushing your teeth.[23]The debris index score decreased after being given the modio puzzle education model (audio modification) which contained information about how to brush your teeth. This is in line with previous research which states that brushing your teeth with good and correct techniques will improve oral and dental hygiene.[29]

IV. CONCLUSION

The modio puzzle education model (audio modification) is feasible and effective as an effort to reduce index debris in children with Down syndrome. There was a difference in index debris in the intervention group before and after being given the modio puzzle education model (audio modification) with a p-value of 0.000. The debris index number will decrease if respondents apply good and correct methods of brushing their teeth. There is a difference in the debris index in the control group before and after being given treatment with a p-value of 0.000. The ability to brush your teeth properly and correctly is an important factor in maintaining oral hygiene. The Modio puzzle (audio modification) is more effective in reducing the debris index in children with Down syndrome with a difference of 0.85 compared to Widi's 3D Gosgi modified puzzle which is only 0.43. Audio-visual media is more effective in reducing index debris than visual media alone.

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