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Interactive Media with Android Based Sign Language as an Effort to Improve Dental Health Maintenance Behaviour and Decrease Debris Index in Deaf Children

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ABSTRACT

Deaf children in the intervention group had 100% caries and an average debris index of 80%, indicating poor dental and oral hygiene. To address this issue, interactive media with Android-based sign language and game methods was used for engaging and enjoyable learning. This research aims is used to produce interactive media with android-based sign language as an effort to improve dental health maintenance behavior and decrease debris index in deaf children. This research method is Mixed Method and Research and Development (R&D) research design. There are five stages of research, namely: information collection, model design, expert validation and revision, model testing with quasi-experimental methods with pre-test design – post-test control group design. The results of interactive media with Android-based sign language according to expert validation average 95% and p value = 0.007 (very feasible). The results of the paired data effectiveness test in the intervention group with a knowledge value of p = 0.008 with a delta value of 2.666, attitude value p = 0.005 with a delta value of 3.916, skill value p = 0.004 with a delta value of 6.250, debris index score p = 0.001 with a delta value of 1.350, compared to the control group. So that this interactive media with android-based sign language is feasible and its application is effective as an effort to improve dental health maintenance behavior and reduce debris index in deaf children.
Keyword: Deaf children, behavior, dental health, interactive media with sign language

Introduction

Dental and oral health is an integral part of general health that affects the quality of life, especially in school-age children who are in the stage of forming healthy habits and behaviors[1]. Children with sensory disabilities, especially those who are deaf, face more complex challenges in maintaining dental and oral health[2]. The main obstacle lies in limitations in verbal communication and information reception, which has an impact on low knowledge and skills in maintaining oral hygiene[3]. This limitation makes deaf children more susceptible to caries problems and poor oral hygiene[4].

Health in deaf children that refers to the malfunction of a child's hearing or ear organs[5]. This condition causes them to have different characteristics compared to normal children, particularly in terms of dental and oral health. The dental health of deaf children tends to be poorer than that of normal children due to both mental and physical limitations, as well as challenges in performing optimal oral hygiene independently[6].

Dental health problems in deaf children in the intervention group showed a 100% risk of experiencing caries, and their oral hygiene status had an average debris index of 80%, which falls into the poor category. Oral and dental health are closely related to individual behavior[7]. Good dental and oral health maintenance behaviors will play a role

in determining the health degree of each individual[8]. Poor dental and oral health maintenance behaviors need to be improved. [9]

Some previous studies have shown that conventional methods in health education, such as lectures and printed books, are less effective when applied to deaf children due to incompatibilities with their visual-kinesthetic learning styles[10]. The use of visual-based learning media, such as sign language educational videos, has shown a significant improvement in the dental health knowledge and attitudes of deaf children[11]. However, these studies have not extensively explored a ground-based gamification approach, which could enhance engagement and support the development of sustained habits.

Develop dental health information and promote the prevention of dental and oral diseases in deaf children by providing education about oral health using sign language learning media that is accessible and understandable for them [12].

Android-based sign language interactive media is one of the operating systems that supporting deaf children's learning programs, have special characteristics in encouraging children deaf to be able to learn independently. Media Android-based interactive sign language that needs to be developed at every level of education is innovation in the presentation of learning materials. Android-based sign language media can help in learning and learning to be not boring, and will help students in understanding the content of the material[13].

This media combines visual, interactive, and educational play elements that can improve the attractiveness, understanding, and skills of deaf children in brushing their teeth correctly. While there are several app-based educational innovations for children with special needs, very few have integrated sign language specifically for dental health education and tested it systematically through developmental and experimental research methods.

Methods

This research uses a Research and Development (R&D) design with a Mixed Method approach, which consists of five main stages: (1) initial information collection, (2) media model design and development, (3) validation by experts, (4) model testing through quasi-experimental design, and (5) result analysis and final revision.

The research was carried out at Extraordinary Schools (SLB) in the Semarang area, from May to July 2023. The population in this study is deaf children who attend the SLB. A purposive sampling method was employed, involving 12 participants who were assigned to two groups: an intervention group utilizing interactive Android-based media with sign language, and a control group receiving conventional education through smart books. The selection of the sample count refers to the Slovin formula and considers inclusion and exclusion criteria. Inclusion Criteria: Deaf children aged 11-15 years, Deaf children who have android and can apply android, Cooperative and Willing to be a respondent during the study. Exclusion Criteria: Not attending school at the time of the study and not willing to be a respondent

This study has obtained ethical clearance with the approval number 0782/EA/KEPK/2022.

Results and Discussion

Information collection was carried out through the interview method. It can be concluded that deaf children have a slow response compared to normal children because they use sign language and children tend to be silent. Media suitable for deaf children such as video media, mirrors, real objects, maple books, the internet, picture media, and interesting game media models for deaf children who will stay focused on the goal they want to convey. Dental and oral care education efforts that have been provided are information from the health center to students and teachers about dental and oral health.

From the results of information collection, educational media has not been found that combines visual-interactive features, sign language, and educational games designed specifically for deaf children in the context of dental health. Existing education methods are still one-way, without monitoring or active interaction that can form a consistent toothbrushing habit. This gap shows the importance of media innovation that not only conveys information, but is also able to internalize behavior through a multisensory approach and digital reinforcement of positive behaviors.

Therefore, it is necessary to develop an interactive Android-based educational media, equipped with sign language, educational visuals, and gamification features that are fun and able to monitor toothbrushing behavior in real-time. This media is expected to increase information absorption in deaf children through learning experiences that suit their visual-kinesthetic learning style. In addition, the application of

gamification principles can encourage active engagement, motivation, and behavioral consistency, which cumulatively form the habit of maintaining dental and oral hygiene in a sustainable manner. With this approach, interventions are not only informative, but also transformational in shaping positive dental health behaviors.

The design the model using the ADDIE (Analysis, Design, Development, Implementation, Evaluation) framework. The validation process involved three experts specializing in information technology, dental health education, and media. This validation served as a foundation for assessing the feasibility of the Android-based interactive media incorporating sign language, aimed at improving dental health behavior in deaf children. Each expert completed a questionnaire consisting of 10 items.

The trial of this product was carried out on deaf children who were divided into 2 groups, namely the intervention group and the control group. The researcher provides education to deaf children using sign-based media that can be understood by deaf children at school, intervention groups in the form of learning media, namely interactive media with android-based sign language to deaf children and the provision of smart book media to the control group.

The result of the model is one of the innovations of game-based promotive and preventive efforts to change toothbrushing behavior in elementary school children.

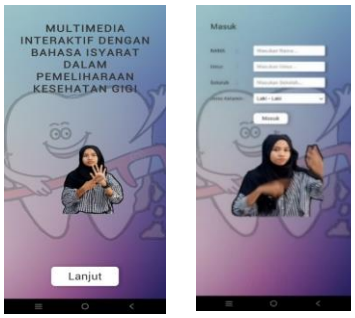

Figure 1. App Preview

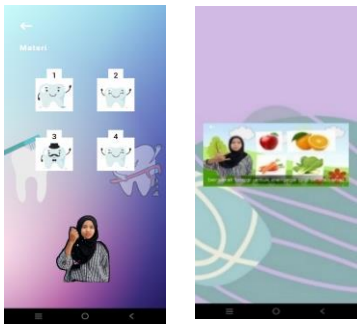

Figure 2. Materials Menu

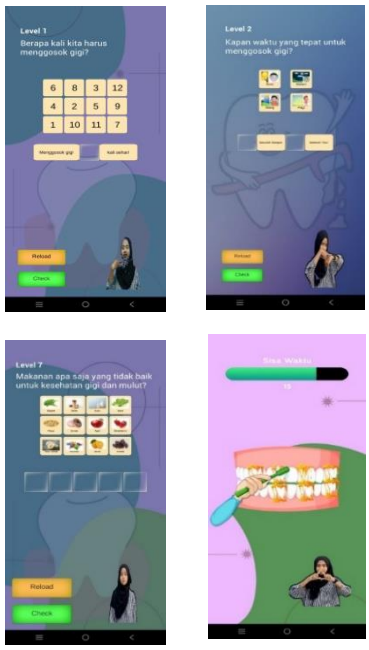

Figure 3. Game Menu Display

Table 1.
Test the effectiveness of paired and unpaired data on behavioral variables and index debris scores in the intervention group

Variabel	Group	Mean ± SD Pre test	Mean ± SD Post test	*P-Value*
Knowledge	Intervention	5,67 ± 1,073	8,33 ± 0,888	0,001*
	Control	5,42 ± 0,996	7,33 ± 0,888	0,058*
Attitude	Intervention	4,75 ± 0,965	8,67 ± 0,985	0,003*
	Control	4,83 ± 0,937	7,25 ± 0,965	0,165*
Skills	Intervention	19,83 ± 2,209	26,08 ± 1,676	0,012*
	Control	17,50 ± 3,090	21,92 ± 1,564	0,084*
Debris Index Score	Intervention	2,300 ± 0,443	0,950 ± 0,323	0,006*
	Control	2,358 ± 0,290	1,317 ± 0,428	0,144*

**Paired t-test* ***Independent t-test*

The results of the paired data test in the knowledge variable intervention group obtained *p-value* value (<0.05) which means that there are differences in knowledge, attitudes, and skills. And *the index debris* score before and after treatment in the intervention group, while the paired data test in the knowledge variable control group obtained a *p-value* of 0.058, *an attitude p-value* of 0.165, an *action p-value* of 0.084, and *the index debris* score were all *p-values* of 0.144, *p-values* control group (>0.05) which means that there is no meaning, no difference in knowledge, attitude, skill *debris score index* before and after treatment in the control group.

Table 2.
The Influence of Variables of Knowledge, Attitudes, and Skills on the Reduction of Index Debris

Variabel	B	*P-Value*	R	R Square	Adjusted R Square	*P-Value Anova*
Knowledge	0,199	0,015	0,676	0,657	0,643	0,006
Attitude	0,050	0,542				
Skills	0,016	0,479				

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The results of the analysis showed a *p-value* of 0.006 (>0.05) which means that there is an influence of knowledge, attitudes and skills on the reduction of index debris scores in deaf children. The results of the analysis showed a value of R = 0.676 (>0600) which means that the strength of the relationship is in the category of strong correlation. The square R and customized values of 0.657 and 0.643, respectively, mean that there is an influence of knowledge, attitudes and skills on the decrease in the debris index score in deaf children by 65.7%.

Table 3.
The Influence of Knowledge, Attitudes, and Variable Skills on the Debris Score Index

Variabel	B	R	R Square	C	F Square	F	*P-Value*
Knowledge	0,068	0,645	0,416	0,475	3,13	4,274	0,019
Attitude	0,015						
Skills	0,070						

Based on the test results seen in the table, the *results* show p value (p<0.05) and an F value of 4.274 > F the table means that it can be concluded that there is an influence between knowledge, attitude, and toothbrushing skills on the decrease in index debris scores in elementary school children.

The method of learning activities at SLB uses the lecture method with sign language and uses book media. However, the lecture method and book media applied to deaf children are less effective because children easily forget the material that has been delivered. Deaf children are more interested in learning by using motion media methods such as animated videos, animated video media can increase motivation and stimulate learning activities, but video media in SLB does not yet cover maintaining dental health, the media is still used in general learning therefore video media about maintaining dental health can be one of the alternative new learning media about maintaining dental health in deaf children in SLB. In line with the results of previous research, learning media in the form of videos for deaf children can make it easier to deliver learning materials[14].

The application of Android-based interactive media models and gamification in these media can increase the interest of deaf children in learning and knowing information about the importance of maintaining dental health.

* Android-based interactive media is a learning medium that can be used in the dental health education process for deaf children which aims to instill new habits to form new behaviors in dental health maintenance by using learning methods from watching interactive videos in sign language and by playing gamification methods. These efforts are carried out Regularly, actions carried out continuously will give rise to new habits in deaf children.

The increase in knowledge in deaf children because the stimulus/stimulus of information provided to deaf children through education has an effect on knowledge or cognition in deaf children provided through educational media that is interesting, clear, easy to understand so that the stimulus is accepted. and the attention of individuals so that there is an increase in knowledge in children[15].

The results of the analysis test of the variable data paired with the average attitude value there was a significant difference before and after treatment, namely 4.75 increased to 8.67, the average difference was 3.916 and the value of p-value 0.003 can be interpreted as the application of an android-based interactive media model effective in improving the attitude of deaf children. Attitudes are influenced by knowledge, the more knowledge increases, the more children's attitudes about how to brush their teeth properly and correctly[16].

Brushing skills are provided through android-based interactive educational video media, then the documentation of brushing teeth in the morning

after breakfast and the night before going to bed, namely respondents upload evidence of brushing activities on interactive media applications, uploading proof of toothbrushing skills is carried out for 21 days. The uploaded data automatically enters the operator's system for monitoring. The formation of regular brushing behavior for 21 days will form a new behavior of children's habits in brushing their teeth[17].

This study shows that Android-based interactive media with sign language has significant effectiveness in improving dental health maintenance behaviors and lowering the debris index in deaf children. One of the important findings of this study is a significant improvement in the child's knowledge aspect after being given an intervention. This is because visual media equipped with sign language is able to adapt to the learning characteristics of deaf children who rely more on visual communication and body movements. This media is able to present health information in a clearer, more interesting, and easier to understand manner, thereby accelerating the process of understanding the concept of dental hygiene. These findings reinforce the concept of multisensory learning and are consistent with previous findings that video-based visual education media are very effective in improving the knowledge of children with hearing loss.

Educational games are innovative and challenging educational media for children, so that they can learn independently and participate directly[18]. Maintaining oral hygiene is essential, and better brushing behavior will result in better dental and oral hygiene[19]. Children's behavior in maintaining dental cleanliness directly affects their level of dental and oral hygiene [20]. In addition, monitoring tooth brushing activities will be able to affect the skills of respondents, Consistently brushing teeth twice a day, specifically after breakfast and before going to bed, helps decrease the level of dental debris [21].

A significant decrease in the debris index in the intervention group showed that this medium not only had an impact on theoretical aspects of knowledge and skills, but also provided tangible results in the form of improved oral hygiene. This decrease in the index is proof that the behavior formed through educational media is really applied in children's daily lives. This shows the effectiveness of media as a technology-based health promotion tool that is able to reach groups with special needs more effectively.

When compared to previous research, this study shows its own advantages. Most previous studies have only used video media or print modules without sign language integration and without a monitoring mechanism for brushing behavior. This research fills this gap by presenting Android-based educational media that is not only informative and interactive, but also able to monitor, motivate, and assess children's behavior directly. Thus, this research has novelty in the approach to inclusive technology-based dental health education.

Conclusion

The interactive media with Android-based sign language developed in this research achieved an average expert validation score of 95% (p-value = 0.007), indicating its high feasibility and readiness for use. Furthermore, the effectiveness test demonstrated a significant improvement in dental health maintenance behavior and a decrease in the debris index among deaf children in the intervention group after using the media. This suggests that the interactive media with Android-based sign language is an effective and feasible tool to enhance dental health maintenance behavior and reduce the debris index in deaf children.

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