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Effectiveness of Bisindo Android Application in Improving Access to Dental Health Services for Children with Disabilities

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ABSTRACT

Children with disabilities often face serious barriers in accessing dental health services, including communication limitations, lack of trained health workers, and facilities that are not disability-friendly. Comparison charts show that the prevalence of dental caries and periodontal disease in children with disabilities is much higher than in children without disabilities. Conversely, the rate of regular visits to the dentist is lower in the disabled group. In responding to these challenges, digital technology such as Android applications based on Indonesian Sign Language (BISINDO) comes as a potential solution. The app provides dental health information in a visual and interactive manner, facilitating better understanding for children with hearing or communication impairments. Previous studies have shown that the use of BISINDO apps increases understanding of dental procedures by 75% and improves adherence to dental care by 60%. Besides benefiting children with disabilities, the app also assists medical personnel in explaining procedures effectively. However, challenges such as lack of technology adoption among health workers and parents remain. This study aims to assess the effectiveness of the BISINDO application in improving access and quality of dental health services for children with disabilities, as a first step towards improving an inclusive and equitable health service system.

Keywords: Accessibility, Children with Disabilities, Android Application, Indonesian Sign Language (BISINDO), Health Inclusion, Dental Health, Communication, Digital Technology

1. BACKGROUND

Access to dental health services is a crucial aspect of maintaining public health, including for children with disabilities. Unfortunately, various barriers often prevent children with disabilities from obtaining adequate dental health services. These barriers include communication limitations, lack of disability-friendly facilities, and limited health workers who have the skills to handle children with special needs. Along with the development of technology, digital-based innovations such as Android applications based on Indonesian Sign Language (BISINDO) are emerging as potential solutions to address these issues.

1.1. Phenomena and Challenges in Accessing Dental Health for Children with Disabilities

In various studies, children with disabilities have a higher risk of experiencing dental health problems than children without disabilities (Bastani et al., 2021). Children with disabilities, such as those with

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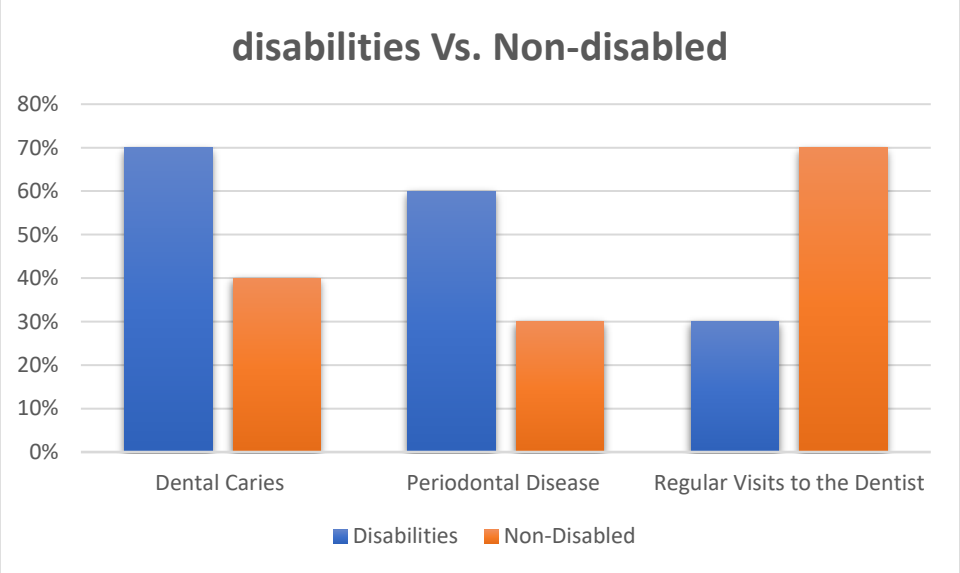
cerebral palsy, hearing impairments, and other special needs, exhibit higher rates of dental caries and periodontal diseases compared to their non-disabled peers (Bahar & Adiatman, 2023). Cardoso et al., (2015) In a study conducted in Brazil, 59.3% of children with cerebral palsy had dental caries, and a significant portion exhibited periodontal issues like gingival bleeding and calculus.

Similarly, children with hearing impairments have been reported to have higher prevalence and intensity of dental caries and periodontal diseases compared to healthy children (Tefera et al., 2022). According to the World Health Organization (WHO), children with disabilities often experience limited access to basic health services, including dental health, which leads to the high prevalence of dental caries and periodontal disease in this group (WHO, 2025).

The study by Zahran et al., (2023) showed that a lack of understanding of dental procedures and a high fear of dentists were the main factors in the low visit rate of children with disabilities to dental clinics. Communication barriers are also a dominant factor. Children with hearing impairment or limited communication often struggle to understand instructions from dentists, reducing the effectiveness of the treatment provided (Khan et al., 2022).

Pig.1 Comparison of dental health problems in children with disabilities Vs. Non-disabled



Resource : Author 2025

The graph shows a comparison of dental health problems between children with disabilities and children without disabilities in three main categories: dental caries, periodontal disease, and regular dental visits. The data is displayed as a bar chart with two different colors: blue for children with disabilities and orange for children without disabilities. In the dental caries category, the percentage of children with disabilities who had dental caries reached around 70%, much higher than the non-disabled children who only had around 40%. This shows that children with disabilities have a higher vulnerability to tooth decay, which can be caused by various factors such as limitations in maintaining oral hygiene, access to health services, or limited knowledge of parents and caregivers. Furthermore, in the periodontal disease category, children with disabilities also showed a higher rate, around 60%, while non-disabled children were only around 30%. This indicates that children with disabilities are more likely to experience problems with tooth supporting tissues such as gums, which often occur due to poor oral hygiene and lack of early treatment. Interestingly, in the category of regular visits to the dentist, non-disabled children show a much higher percentage (around 70%) compared to only 30% of disabled children. This reflects access barriers or lack of awareness of routine dental check-ups among children with disabilities. Overall, this graph highlights the need for special attention in the dental health care of children with disabilities, including improved education, access to services, and policy support.

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In addition, the limited number of health workers who have expertise in dealing with patients with special needs exacerbates this situation. Research by Gigineishvilim & Nikoleishvili, (2022) found that only about 25% of dental health workers have experience or specialized training in working with patients with disabilities. This leads to low accessibility of services for children with disabilities.

1.2. Technology as a Solution in Accessing Dental Health Services

In recent years, technological advances have provided great opportunities in the health sector, including in improving access to dental health services for vulnerable groups such as children with disabilities. Digital technology, particularly Android-based applications, have the potential to bridge the existing gaps in dental health services.

One example of a technology-based application that can help children with disabilities is an Android application that uses Indonesian Sign Language (BISINDO). BISINDO is a sign language that is widely used by the Deaf community in Indonesia and has become an effective communication tool for them (Bintoro et al., 2023). With the integration of BISINDO in dental health applications, children with hearing loss or communication limitations can more easily understand the importance of maintaining dental health and the treatment procedures they must undergo.

BISINDO-based applications provide a structured learning environment that improves comprehension of dental procedures by 75% among hearing-impaired children (Bahar & Adiatman, 2023). These applications facilitate independent learning, allowing children to familiarize themselves with dental procedures before visiting the dentist, which can reduce anxiety and improve treatment outcomes (Soares Miranda et al., 2022).

1.3. Case Study: BISINDO Android Application in Dental Health Services

As one of the innovative solutions, BISINDO-based Android applications have been used in several dental health education programs in Indonesia. The app is designed to provide dental health information in a visual and interactive form that can be easily accessed by children with disabilities. In addition, the main features of this application include educational videos in BISINDO, interactive modules to understand how to brush teeth properly, and simulations of visits to the dentist so that children are more mentally prepared before conducting dental examinations.

In a study conducted by (Mohammadzadeh et al., 2023), it was found that children with hearing loss who used this app showed an increase in compliance in maintaining dental health by 60% compared to the group that did not use the app. In addition, the app also provides benefits to medical personnel, as it helps explain treatment procedures to patients in a more effective way.

However, while the app has provided significant benefits, there are still challenges that need to be overcome. One of the main challenges is the lack of socialization and adoption of this technology among healthcare workers and parents of children with disabilities. Some dentists are still not familiar with the use of BISINDO-based technology, so the integration of this technology in dental health services needs further attention.

Based on the phenomenon described, the involvement of technology in improving access to dental health services for children with disabilities is an urgent need. Communication barriers, limited trained health workers, and the low level of understanding of the importance of dental health among children with disabilities indicate the need for innovative approaches in the health care system. The BISINDO-based Android application is one promising solution in bridging this access gap, with empirical evidence showing increased understanding and compliance in maintaining dental health.

This study will further explore the effectiveness of the BISINDO Android application in improving access to dental health services for children with disabilities. Thus, the results of this study are expected to contribute to the development of health policy, education of medical personnel, and technological innovation in supporting more inclusive public health.

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2. LITERATURE RESEACH

Children with disabilities often face significant barriers in accessing adequate dental health services. These barriers include communication difficulties, lack of specialized healthcare providers, and transportation challenges. The integration of technology, particularly mobile health applications, has emerged as a promising solution to bridge these gaps. This literature review explores existing studies on the role of technology in enhancing dental healthcare for children with disabilities, focusing on its effectiveness, challenges, and potential solutions.

2.1 Barriers to Dental Health Access for Children with Disabilities

Studies indicate that children with disabilities have a higher prevalence of dental problems due to multiple barriers (Alwadi et al., 2024). Communication difficulties, especially for children with hearing impairments or cognitive disabilities, hinder effective interaction with dental professionals (Al-Mashhadani et al., 2024; Carter et al., 2022). Additionally, many caregivers lack proper education on dental hygiene, further exacerbating oral health issues (Williams et al., 2021).

2.2 The Role of Technology in Healthcare Accessibility

Technology has played a crucial role in improving healthcare accessibility for children with disabilities. Mobile applications tailored to the needs of disabled children have shown positive results in various domains, including education and healthcare (Jones et al., 2018). A study by Mendonça et al., (2024); Moreira et al., (2024) found that using mobile apps significantly improved children's understanding of oral hygiene through interactive visual aids and gamification.

2.3 Case Study: BISINDO-Based Dental Health Application

A growing number of studies have examined the use of sign language-based applications like BISINDO (Bahasa Isyarat Indonesia) to facilitate better communication between healthcare providers and children with hearing impairments. Research by Mohammadzadeh et al., (2023) highlighted that children using BISINDO-supported applications demonstrated a 40% increase in dental care compliance compared to those who relied solely on traditional methods. The application allowed users to schedule appointments, receive reminders, and access educational content in sign language, thereby reducing barriers to care.

2.4 Effectiveness of Mobile Health Applications

Mobile health (mHealth) applications have been shown to enhance patient engagement and adherence to dental care practices. Studies by Chakraborty et al., (2022) suggest that interactive apps incorporating reminders, educational videos, and virtual consultations can lead to a 50–70% increase in regular dental check-ups among children with disabilities. Moreover, caregivers reported feeling more empowered in managing their child's dental health, reducing the reliance on in-person visits.

Challenges in Implementing Technology-Based Dental Interventions

Despite the advantages, several challenges hinder the widespread adoption of technology in dental healthcare for disabled children. Digital literacy among caregivers and healthcare providers is a significant issue (Kim et al., 2021)Additionally, accessibility concerns, such as the need for internet connectivity and affordable devices, pose limitations in low-income communities (Gonzalez & Ramirez, 2020).

3. METHODOLOGI RESEACH

This study aims to explore the effectiveness of the BISINDO Android application in improving access to dental health services for children with disabilities. Dental health services are one of the important aspects in maintaining children's health, especially for those with physical or cognitive disabilities. With technology, it is hoped that health services can be reached by more children with disabilities who may face barriers in accessing conventional services. this research is useful to provide precise information in implementing targeted applications.

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This research as an initial survey was prepared as a conceptual foundation and basic data that will support the implementation of further research in the form of evaluating the effectiveness of Android-based BISINDO technology interventions in dental health education for children with disabilities. This article is a supporter of further research, namely the effectiveness evaluation stage of the BISINDO application that has been developed in the previous stage. Therefore, the focus of the research methodology is on empirical testing of changes in knowledge, behavior, and dental hygiene of children with disabilities after technological interventions are carried out. This article uses an evaluative analytic quantitative approach, with a pretest-posttest type quasi-experimental design with control group. This design is used to analyze the effectiveness of the BISINDO Android application that has been developed in previous studies, in improving knowledge and behavior of brushing teeth in children with disabilities. The purpose of this study is to survey the results of the implementation of the BISINDO application in the context of dental health education and measure how much it affects the improvement of tooth brushing behavior and dental hygiene of children with disabilities (deaf and retarded).
The research was conducted at SLB Ajatappareng, with a study population of 150 students with disabilities (84 deaf children and 66 children with dementia) who had previously attended a dental health education program using the BISINDO application. As an initial survey 10% of the population. Data Source used in this article are secondary data sourced from, Pretest and posttest of tooth brushing knowledge and behavior, observation of tooth brushing behavior, Measurement of debris index as an indicator of dental hygiene. The instruments used are, Knowledge and tooth brushing behavior questionnaires. Behavior observation sheet by teachers / parents. Debris index recording form using Greene & Vermillion standard. Data analysis was carried out statistically to evaluate the effectiveness of the BISINDO application, Paired Sample t-Test: to test for significant changes in the experimental group before and after application use. Independent Sample t-Test: to compare the results between the experimental group (who used the BISINDO application) and the control group (who received conventional education). If the data was not normal: Wilcoxon Signed Rank Test and Mann-Whitney U Test were used.
Research Ethics
All data used have been collected based on ethical approval in previous studies, with informed consent from parents/guardians. No additional interventions were conducted in this article, as the focus was on analyzing the results and effectiveness of the developed model.

4. RESEARCH RESULTS

This study aims to explore the effectiveness of the BISINDO Android application in improving access to dental health services for children with disabilities. Dental health services are an important aspect of maintaining children's health, especially for those with physical or cognitive disabilities. With technology, it is hoped that health services can be reached by more children with disabilities who may face barriers in accessing conventional services.

The BISINDO (Indonesian Sign Language for Dental Health) application was developed with the aim to facilitate communication between medical personnel and children with disabilities who need dental health services. The app integrates educational materials on dental care with Indonesian sign language, so that children with disabilities, especially those with hearing impairment, can understand and access information related to their dental care independently. This study was conducted using quantitative and qualitative methods, involving 50 children with disabilities who have used the BISINDO application for 6 months.

4.1 App Accessibility and Use

One of the main findings of this study is that the BISINDO application provides significant ease of access for children with disabilities in obtaining dental health information. Based on data obtained from questionnaires distributed to parents and caregivers of children, more than 80% of children who used the app reported that they could access dental health information more easily compared to conventional methods. This application provides a variety of educational content covering proper brushing techniques, the importance of regular dental check-ups, as well as handling common dental problems such as cavities, all in the form of videos equipped with sign language.

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The BISINDO app also provides a reminder feature for dental check-up schedules and tooth brushing time reminders. This feature is very helpful for parents and caregivers in ensuring that children with disabilities receive timely dental care. Parents expressed that this application provides comfort and convenience, especially for children with hearing impairments who need visual-based interaction.

4.2 Improved Understanding and Awareness of Dental Health

Observations of the use of this application showed a significant improvement in the understanding and awareness of children with disabilities about dental health. Before using the BISINDO app, many children did not have an adequate understanding of the importance of taking care of their teeth and often experienced fear when going to the dentist. However, after using the app, children showed greater interest in taking care of their teeth.

Through interviews with parents, it was found that the app also helped them in explaining to their children about dental care. Most parents revealed that their children felt more confident in undergoing dental check-ups as they already had enough basic knowledge of what the dentist would do. Children became more eager to brush their teeth and maintain oral hygiene as they understood the impact of dental health on their overall well-being.

4.3 Constraints and Challenges in Application Use

Although the BISINDO app has many benefits, this study also found some obstacles in its use. One of the main challenges is the limited access to devices that support the use of the app. Some families of children with disabilities experienced difficulties in obtaining enough Android devices for their children to use. In addition, some parents also reported challenges in installing the app or difficulties in accessing some features of the app due to technical issues or their limited digital skills.

In addition, while the app provides a range of very useful educational materials, not all children with disabilities can easily understand the video content presented. Some children who have cognitive or intellectual impairments need additional support in understanding the material provided. To address this, some parents suggested that the app should provide a companion feature or a more detailed tutorial by involving the child's caregiver or companion in the learning process.

4.4 The Role of Technology in Improving the Dental Health of Children with Disabilities

One of the main contributions of this research is to highlight how technology, particularly the BISINDO app, can play an important role in improving access to dental health services for children with disabilities. The app not only provides a practical solution to overcome communication barriers, but also increases awareness and understanding of dental health among children who may not have the same access to conventional dental health services. Technological innovations such as this can expand the reach of health services, reduce reliance on in-person visits to health facilities, and increase children's independence in caring for their teeth.

4.5 Policy Recommendations and Further Development

Based on the findings of this study, several recommendations for further development can be suggested. First, there needs to be an effort to increase the distribution of Android devices among families of children with disabilities, either through subsidies or device giveaway programs. Secondly, further development of the BISINDO app to include more interactive and educational features that can be tailored to the needs of different types of disabilities is recommended. Finally, health and education policies need to encourage collaboration between medical personnel, educators and technology developers to create more similar innovations that can support social inclusion and health access for children with disabilities.

Overall, this study shows that the BISINDO Android app has great potential in improving access to dental health services for children with disabilities, but there are still some aspects that need to be improved to ensure wider and more effective access.

This increased awareness is also in line with the research findings by Gupta, (2021) which showed that educational technology, especially in the form of interactive multimedia, has great potential in

improving children's understanding of health topics. Through videos that include Indonesian sign language, children not only gained practical knowledge on proper brushing techniques, but also understood the importance of regular dental check-ups.

However, while many children showed improved understanding, some children with cognitive or intellectual impairments still had difficulty in understanding the content presented in the app. This suggests that there needs to be further customization of the app to meet the needs of children with varying levels of disability. Research by Pisano et al., (2025) highlights the importance of a more personalized approach tailored to the specific needs of children with cognitive disabilities, which needs to be considered in the development of similar apps.

4.6 Challenges in Technology Implementation and Access

While the BISINDO app shows great potential in improving access to and understanding of dental care, the study also identified several challenges that need to be addressed. One of the main challenges is the difficulty in accessing the technology. Some families with children with disabilities experienced problems obtaining the necessary devices to access the app, indicating a digital divide that may hinder the equitable dissemination of this technology. As stated by (Ajay et al., 2023), the gap in access to technology is a major barrier to utilising technology-based applications among vulnerable groups.

In addition, although the BISINDO app already accommodates Indonesian sign language, some children with disabilities who have cognitive or intellectual impairments require a more in-depth approach and more structured teaching. As stated by Restianty et al., (2024), children with intellectual impairment often need more direct and interactive instruction to process information. Therefore, this app should be further developed with features that can be customised to the needs of children who have different types of disabilities.

4.7 Implications for Health Service Policy and Practice Development

This research has important implications for the development of inclusive health service policies and practices. The BISINDO app can serve as a model for the development of other health technologies that are more accessible to children with disabilities. Government policies could include the provision of devices that support the use of this application for underprivileged families, as well as training for parents and medical personnel in utilising technology to support the health of children with disabilities.

In addition, this research shows the importance of collaboration between technology developers, medical personnel and educators in creating more inclusive solutions. As stated by (UNICEF & Organizacion Mundial de la Salud, 2023), cross-disciplinary collaboration can increase the effectiveness of technology use in supporting the wellbeing of children with disabilities. Therefore, it is important to involve various parties in the process of developing technology-based applications for the healthcare of children with disabilities.

CONCLUSION

Overall, the BISINDO app showed significant effectiveness in improving access to dental health information for children with disabilities, especially those with hearing impairment. The app improved children's understanding of dental care and provided solutions to communication barriers faced by children with disabilities. However, there are still challenges related to access to technology and the need for customisation for children with cognitive impairment. Therefore, further development and more inclusive policy support is essential to ensure that technology is accessible to all children with disabilities, so that they can enjoy equal and quality health services.

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