Original Research Article

Android-Based Toothbrushing Monitoring Calendar for Children with Intellectual Disabilities in Jambi City

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ABSTRACT

Children with intellectual disabilities (tunagrahita) have limitations in intellectual abilities and adaptive skills, including maintaining oral and dental hygiene. This condition makes them more vulnerable to dental health problems compared to normal children. Various educational media have been used, such as toothbrushing monitoring cards, but these still have weaknesses because they are paper-based, easily lost, and less engaging. This study aims to develop an Android-based toothbrushing monitoring calendar application (MOGOGI) as an innovative solution to establish toothbrushing habits among children with intellectual disabilities and to increase parental involvement in daily supervision. This research employed a Research and Development (R&D) design using the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation). The research subjects included two validators (a material expert and a technology expert) and 15 pairs of parents and children with intellectual disabilities at SLBN 2 Jambi City, selected through purposive sampling. The research instruments consisted of expert validation questionnaires, user feasibility questionnaires, and parental knowledge tests before and after the intervention. Data were analyzed descriptively (quantitative and qualitative) and statistically using SPSS. The results showed that the MOGOGI application was highly feasible, with a feasibility score of 100% from the material expert and 86% from the technology expert. The user trial also obtained an average rating above 85% on aspects of appearance, usability, and benefits of the application. Parents' knowledge significantly increased after the intervention, with most knowledge indicators reaching 100% in the post-test. The MOGOGI application proved effective as an educational and monitoring tool, and it helped children with intellectual disabilities become more disciplined in toothbrushing. In conclusion, the Android-based toothbrushing monitoring calendar application is feasible and effective for improving toothbrushing habits in children with intellectual disabilities, while also facilitating parents in providing daily supervision.

Keywords: Intellectual Disability, Oral Health, Android Application, Toothbrushing Habits, Health Education

INTRODUCTION

Oral and dental health remains one of the major public health problems in Indonesia [1–4]. Data from the Indonesian Health Survey (SKI) in 2023 showed that the prevalence of oral and dental health problems was 56.9%, while only 6.2% of

the population brushed their teeth correctly, even though 72% reported brushing their teeth daily. This condition is even more concerning among children, particularly children with special needs (CWSN), including children with intellectual disabilities, who have limitations in intellectual and adaptive functioning, making it difficult for them to maintain personal hygiene, including oral and dental hygiene [5]. Children with intellectual disabilities face unique challenges in understanding instructions and carrying out toothbrushing routines, which results in a higher prevalence of dental caries in this group compared to normal children [6].

Despite various efforts, there are still gaps in practice. For instance, the use of toothbrushing monitoring cards has been quite effective in improving the oral health behavior of children with special needs, but this medium has weaknesses as it is paper-based, easily lost, not environmentally friendly, and less engaging for children with intellectual disabilities [7]. This indicates that conventional strategies have not been fully effective in establishing consistent and sustainable toothbrushing habits [8].

From the research perspective, there is a gap in studies related to the lack of digital technology innovations to support oral health behaviors in children with intellectual disabilities [9]. Several previous studies have shown the effectiveness of visual media or simple digital applications in improving oral health knowledge among normal children as well as children with special needs. However, most of the applications developed have not been integrated with daily monitoring features, automatic reminders, and reward systems relevant to the needs of children with intellectual disabilities. These studies also tend to focus more on regular children or other groups of children with special needs, while specific research on children with intellectual disabilities remains very limited [10,11].

The urgency of this study is even clearer considering that children with intellectual disabilities are highly dependent on parental or caregiver support in performing self-care routines. An Android-based toothbrushing monitoring calendar application is expected to be an innovative solution to overcome the limitations of conventional media. This application not only functions as a reminder for toothbrushing schedules but also serves as an interactive educational tool, a monitoring medium, and a motivational aid through a reward system that can increase the involvement of both children and parents [12]. Thus, this study has strategic value in supporting the improvement of oral and dental health among vulnerable groups.

The main objective of this study is to develop and test the feasibility of an Android-based toothbrushing monitoring calendar application specifically designed for children with intellectual disabilities in Jambi City. This application is expected to help children develop regular toothbrushing habits, assist parents in monitoring their children's activities, and provide an engaging, effective, and user-friendly educational medium.

The benefits of this study can be viewed from multiple aspects. For children with intellectual disabilities, this application can help increase motivation, discipline, and self-care skills, particularly in maintaining oral and dental hygiene. For parents, the application serves as a more practical and sustainable monitoring tool compared to conventional media. From the health institution perspective, this study contributes by providing an innovative educational medium that can enrich intervention strategies for improving oral health among children with special needs.

In addition, the academic benefit of this study is to add to the literature on the development of digital media in the field of dental health, particularly for children with intellectual disabilities, a group that has rarely been explored. This study is also expected to serve as a reference for future researchers in developing more integrated, user-friendly, and broader-reaching technology-based applications, such as

those integrated with web platforms or telehealth systems. Thus, this research not only provides practical solutions in the field but also contributes to the development of science and technology in the area of oral health for children with special needs.

MATERIALS & METHODS

This study employed a Research and Development (R&D) design with the aim of producing an Android-based toothbrushing monitoring calendar application for children with intellectual disabilities. The development model used was ADDIE (Analysis, Design, Development, Implementation, and Evaluation), as this model is considered systematic in producing a product that meets user needs, starting from problem analysis, design, product development, limited trials, and product feasibility evaluation.

The study was conducted from May to October 2025 at Sekolah Luar Biasa Negeri (SLBN) 2 Jambi City. The location was chosen because it has an adequate number of children with intellectual disabilities that meet the research criteria and allows direct interaction between researchers, parents, and children during the application trial.

The population of this study comprised all children with intellectual disabilities and their parents at SLBN 2 Jambi City. The sample was determined based on inclusion and exclusion criteria. The inclusion criteria included children with mild intellectual disabilities aged 7–15 years, parents willing to accompany and monitor their children, and families committed to participating in all research stages. The exclusion criteria included children with moderate or severe intellectual disabilities, children under 6 years or over 15 years of age, and parents unwilling to participate. Based on these considerations, a sample of 15 pairs of parents and children with intellectual disabilities was selected.

The sampling technique used was purposive sampling, namely the deliberate selection of participants according to predetermined criteria. This technique was chosen because the number of children with mild intellectual disabilities was limited, and the study required specific subjects relevant to the application development goals.

The study variables consisted of independent and dependent variables. The independent variable was the use of the Android-based toothbrushing monitoring calendar application. The dependent variables included toothbrushing habits of children with intellectual disabilities (frequency, compliance, and brushing schedule), parental knowledge of oral and dental health, and application feasibility assessed by experts and respondents. The measurement of these variables was carried out in several ways: application records were used to observe children's toothbrushing habits, pre-test and post-test questionnaires were used to measure parents' knowledge, and a Likert-scale questionnaire was used to assess application feasibility in terms of appearance, content accuracy, usability, and functionality.

Data collection procedures followed the ADDIE model. The analysis stage identified needs, problems, and characteristics of children and parents. The design and development stage involved creating a prototype, which was then validated by a content expert (dental health) and a media expert (information technology). The implementation stage involved a small-group trial with 15 pairs of parents and children using the application according to brushing schedules. Finally, the evaluation stage collected data from application records, knowledge questionnaires, and expert and respondent assessments to determine the effectiveness and feasibility of the application.

Data were analyzed descriptively, inferentially, and qualitatively. Quantitative data from expert and respondent questionnaires were analyzed using percentages and mean scores to determine product feasibility. Parental knowledge data from pre-tests and post-tests were analyzed using the latest version of SPSS software. Application record data on children's

toothbrushing habits were analyzed by calculating daily and weekly compliance percentages. Meanwhile, qualitative data in the form of comments, criticisms, and suggestions from experts and parents were analyzed thematically to provide input for improving the application.

RESULT

Table 1. Distribution of Validation Results by the Content Expert

No	Assessment Aspect	Score
1	Accuracy of toothbrushing steps	5
2	Accuracy of content regarding toothbrushing frequency	5
3	Accuracy of content regarding toothbrushing time	5
4	Accuracy of content on brushing the labial tooth surface	5
5	Accuracy of content on brushing the buccal tooth surface	5
6	Accuracy of content on brushing the palatal tooth surface	5
7	Accuracy of content on brushing the lingual tooth surface	5
8	Accuracy of content on brushing the occlusal tooth surface	5
9	Accuracy of content on brushing the tongue	5
10	Accuracy of content on rinsing	5
11	Completeness of content regarding toothbrushing	5
12	Completeness of content regarding toothbrushing steps	5
13	Sequence of toothbrushing material	5
14	Presentation makes it easier for parents to guide children	5
15	Presentation makes it easier for students to understand the material	5
16	Presentation adds knowledge of dental health	5
17	Presentation encourages students' toothbrushing discipline	5
18	Presentation attracts students' interest	5
19	Presentation stimulates students' curiosity	5
20	Presentation increases students' activeness	5
Total		**100**

In Table 1, the validation results conducted by the content expert show that the Android-based toothbrushing monitoring calendar application has a very high level of feasibility. All assessment aspects, ranging from the accuracy of toothbrushing steps, brushing frequency and timing, to the completeness and sequence of the material, obtained the maximum score of 5. Even the presentation aspects related to parents' ease in guiding their children, students' interest, as well as the potential to increase children's curiosity and activeness, also received perfect scores. With a total score of 100 out of 100, the feasibility percentage of the application in terms of content reached 100%, indicating that the application is highly feasible to use without requiring substantial revisions.

Table 2. Distribution of Validation Results by the Technology Expert

No	Assessment Aspect	Score
1	Application attractiveness	4
2	Clarity and comprehensibility of the physical display	4
3	Appropriateness of color/image combination for children	4
4	Relevance of content to the application	5
5	Suitability of 3D objects with media size	4
6	Clarity of application display	4
7	Display supports content comprehension	4
8	Background quality and color contrast	4
9	Harmony of image layout	5
10	Ease of application use	5
11	Clarity of narration voice	5
12	Attractiveness of background sound	4

13	Contrast of image colors	4
14	Appropriateness of images resembling reality	4
15	Accuracy of images	4
16	Language complies with standard grammar	4
17	Clarity of words	5
18	Language is easy to understand	5
19	Video quality	4
20	Color harmony of background	4
Total		**86**

In Table 2, the aspects that obtained the highest scores were the relevance of the content to the application, the harmony of image layout, as well as the ease of application use and the clarity of the language used. Meanwhile, several aspects such as background sound, image clarity, and video quality received a score of 4, indicating that there is still room for technical improvements to achieve optimal results. Overall, these validation results show that the application is already attractive, easy to use, and suitable for children with intellectual disabilities, although further refinements are still needed in terms of technical quality and navigation.

Table 3. Application Trial Results on Respondents

No	Assessment Aspect	Score
1	Application attractiveness	80%
2	Application clarity and comprehensibility	87%
3	Clarity and comprehensibility of content	87%
4	Clarity and attractiveness of images/photos	90%
5	Clarity of sound or words	87%
6	Language comprehensibility	90%
7	Usefulness of content	87%
8	Video relevance to content	90%
9	Application facilitates parents in guiding children	87%
10	Application facilitates children in understanding toothbrushing techniques	87%

In Table 3, the application trial conducted on 15 pairs of parents and children with intellectual disabilities produced very positive results. Most assessment aspects received high scores, with an average percentage above 85%. The aspects that obtained the highest scores were image clarity and video relevance to the material, each reaching 90%. The language aspect also received very good ratings, as it was considered clear and easy to understand. Meanwhile, the aspect of application attractiveness received the lowest score at 80%, but it was still categorized as good. These results indicate that the application was well accepted by both parents and children and was effective in helping them understand the correct and consistent way of toothbrushing.

Table 4. Pre and Post-Test Results of Parents' Knowledge of Children with Intellectual Disabilities

No	Question	Pre-test (%)	Post-test (%)
1	Each family member should have their own toothbrush	87	100
2	Brush teeth at least twice a day	93	100
3	The correct time to brush teeth in the morning is after breakfast	93	100
4	The correct time to brush teeth at night is before sleeping	100	100
5	Toothbrushing does not need toothpaste	73	100
6	Brushing movements should be done 8 times	100	87
7	It is recommended to rinse before brushing teeth	93	100
8	Brushing the outer front teeth should be done in a circular motion	67	93
9	Brushing the outer back teeth should be done in a circular motion	73	93

10	Brushing the inner upper teeth should be done with an upward stroke	53	87
11	Brushing the inner lower teeth should be done with a downward stroke	87	87
12	The tongue should also be brushed	80	93
13	It is recommended to rinse again after brushing teeth	100	100
14	Watery and fibrous fruits are good for teeth	93	100
15	Sweet and sticky foods do not damage teeth	93	100

In Table 4, the measurement of parents' knowledge before and after the intervention shows a significant improvement. Prior to the intervention, some questions were correctly answered by less than 80% of respondents, such as the importance of using toothpaste (73%), the correct method of brushing the outer front teeth (67%), and brushing the inner upper teeth (53%). However, after using the MOGOGI application, almost all aspects of knowledge improved, with most reaching 100%. The most notable improvements were seen in the importance of using toothpaste, the correct method of brushing the outer front teeth, and brushing the inner upper teeth, which initially had lower scores but increased significantly after the intervention. These findings indicate that the MOGOGI application is effective in improving the knowledge of parents of children with intellectual disabilities regarding oral and dental health.

DISCUSSION

The research findings show that the Android-based toothbrushing monitoring calendar application for children with intellectual disabilities (MOGOGI) is feasible to use in terms of both content and technology, as well as effective in improving parents' knowledge of oral and dental health. This is evidenced by the content expert validation results, which reached 100% with the category of "highly feasible," technology expert validation results of 86% with the category of "highly feasible," and respondent assessments averaging above 85%. In addition, there was an increase in parents' knowledge after using the application, with most knowledge indicators reaching 100% in the post-test.

The high feasibility of the application in terms of content indicates that the material presented aligns with correct dental health principles. This finding is consistent with Notoatmodjo's statement that good health education material must meet the principles of accuracy, sequence, and ease of understanding by the target group [13]. The MOGOGI application not only demonstrates toothbrushing steps but also provides supporting information such as the correct timing for brushing, the use of toothpaste, and additional habits like rinsing and tongue brushing. Thus, the application provides comprehensive education to both parents and children with intellectual disabilities.

From a technological perspective, the feasibility score of 86% indicates that the application is already attractive and suitable for children with intellectual disabilities, although there were some suggestions for improvement regarding technical aspects, video quality, and navigation. The quality of learning media is influenced by design, readability, and interactivity tailored to user characteristics [14]. In this regard, the MOGOGI application already meets these basic aspects, but technical refinements are still necessary to optimize user experience.

The respondent trial demonstrated that the application is easy to use, beneficial, and helps parents guide their children in brushing their teeth. The highest achievement was in image and video clarity, reaching 90%, while the application's attractiveness received the lowest score at 80%. This suggests that visual factors are crucial in enhancing learning interest among children with intellectual disabilities. Kurniawan et al. [15] also emphasized that children with special needs require visual and interactive media to understand dental health concepts. Therefore, the use of digital applications is more effective compared to conventional media such as paper-based monitoring cards.

The pre-test and post-test results of parents' knowledge also showed a significant improvement. Before the intervention, some knowledge was still lacking, particularly regarding inner toothbrushing techniques and the use of toothpaste. After the intervention with the application, almost all aspects of knowledge improved, with most reaching 100%. This improvement supports the findings of Rahmawati [16], who reported that applications with reminders and educational features could improve both frequency and quality of toothbrushing among children. These findings are also consistent with Ningrum et al. [1], who found that the use of digital health applications can increase parents' knowledge of dental and oral hygiene in children with special needs.

Theoretically, the success of this application can also be explained through Skinner's theory of behavior modification, which states that behaviors reinforced (reinforcement) are more likely to be repeated and become habits [17,18]. The reward feature in MOGOGI, in the form of stars, acts as positive reinforcement that motivates children with intellectual disabilities to brush their teeth more consistently. Additionally, the daily reminder alarm supports routine building, in line with the theory of habituation in behavioral psychology. Thus, the application not only improves knowledge but also builds consistent habits.

Practically, this research proves that digital technology can be a solution to improve oral and dental health in vulnerable groups, particularly children with intellectual disabilities. The MOGOGI application contributes to enhancing parental involvement in guiding their children, thereby supporting the sustainability of interventions at home. These results align with Salikun et al. [18], who showed that the SIMOGI application could change parents' behavior in guiding their children's toothbrushing. The difference is that MOGOGI was developed specifically for

children with intellectual disabilities, with more personalized monitoring features.

Therefore, the Android-based toothbrushing monitoring calendar application can serve as an innovative medium that helps develop regular toothbrushing habits in children with intellectual disabilities. In addition to providing easier-to-understand health education, the application also facilitates parental involvement in supporting their children, and it has the potential to become a model of technology-based intervention applicable to children with special needs more broadly.

CONCLUSION

This study successfully developed the Android-based toothbrushing monitoring calendar application (MOGOGI) for children with intellectual disabilities in Jambi City. Validation results showed that the application is highly feasible in terms of both content and technology. The respondent trial also received good ratings, with an average above 85%. In addition, the MOGOGI application was proven to improve parents' knowledge of oral and dental health. The pre-test and post-test results demonstrated a significant increase after using the application.

REFERENCES

1. Ningrum V, Lestari C, Alamsyah Y, Mahata IBE. Pemeriksaan Status Kebersihan Rongga Mulut Anak Menggunakan PHP Indeks pada Siswa-siswi SD di Kecamatan Karawitan, Tabanan, Bali. J Pengabdi Masy Kesehat Gigi FOKGII (JPMKG FOKGII). 2024;1(1):1–7.
2. Zahra AAA, Audrey NW, Ichyana DS, Saskianti T, Pradopo S, Nelwan SC, et al. Effectiveness of the Use of Manual and Electric Toothbrushes and the Effect of Educational Brushing Teeth with Video

Animation on OHI-S Children with Down syndrome. Indones J Dent Med. 2021;4(1):6–10.

3. Ndoen EM, Ndun HJ. Perbaikan Kesehatan Gigi dan Mulut melalui Pemberian Cerita Audiovisual dan Simulasi pada Anak. J Pengabdi Kpd Masy Undana. 2021;15(1):1–7.

4. Purnama T, Sasongko BG, Permatasari L. Media Animated Video Versus Dental Phantom Dolls on Teeth Brushing Skills in Preschoolers: Which is More Effective? Int J Drug Res Dent Sci. 2022;4(3):20–7.

5. Kemenkes. Laporan Riskesdas 2023 [Internet]. April 2024. 2023. Available from: https://www.badankebijakan.kemkes.go.id/laporan-hasil-survei/

6. Khulwani QW, Nasia AA, Nugraheni A, Utami A. Hubungan Pengetahuan, Sikap, dan Perilaku Kesehatan Gigi dan Mulut Terhadap Status Karies Siswa SMP Negeri 1 Selogiri, Wonogiri. e-GiGi. 2021;9(1):41–4.

7. Zoyirov TE, Indiaminova GN. Improvement of Methods of Providing Dental Care for Children with Mental Delay. Cent Asian J Med Nat Sci. 2021;2(6):167–70.

8. Indiaminova GN, Zoirov TE. Improvement Of Methods Of Providing Dental Care For Children With Mental Delayed Development. Am J Med Sci Pharm Res. 2021;3(01):111–6.

9. Suresh S, Indiran MA, Doraikannan S, Prabakar J, Balakrishnan S. Assessment of oral health status among intellectually and physically disabled population in Chennai. J Fam Med Prim Care. 2022;11(2):526–30.

10. Shah RK, Choudhary S, Tandon S. Oral health status in mentally disabled children, dental care knowledge of parents, and the impact of audiovisual oral health education program. Int J Clin Pediatr Dent. 2022;15(2):143.

11. Tatuskar P V, KL V. Mental retardation and oral health: An insight. J Clin Images Med Case Reports. 2021;2(6).

12. Sukhabogi JR, Doshi D, Shwetha S, Gone H, Vasavi K, Shulamithi P. Association between intelligent quotient and oral health conditions among 13–15-year-old intellectually disabled children. Int J Adolesc Med Health. 2022;34(6):411–5.

13. Alphianti LT, Rahma FTA. Perbedaan Tingkat Pemahaman Pengetahuan pada Anak Tunarungu antara Penyuluhan Metode Komik dan Video. Insisiva Dent J Maj Kedokt Gigi Insisiva. 2021;10(1):32–8.

14. Moin M, Saadat S, Rafique S, Maqsood A, Lal A, Ahmed N, et al. Impact of oral health educational interventions on oral hygiene status of children with hearing loss: a randomized controlled trial. Biomed Res Int. 2021; 2021:1–8.

15. Kurniawan J, Dewi O, Leonita E, Nurlisis N, Muryanto I. Efektifitas media sosial youtube modifikasi teka teki silang dalam edukasi kesehatan gigi dan mulut pada siswa-siswi SDN 015 Sungai Sirih. J Kesehat komunitas (Journal community Heal. 2021;7(1):90–6.

16. Rahmawati R. Gambaran Pengetahuan Teknik Menyikat Gigi Remaja Di Desa Genito Kidul Windusari Magelang. Poltekkes Kemenkes Yogyakarta; 2021.

17. Kurniawati D, atiha Bernice SF, Pasha FRA. The effectiveness of dental and oral health promotion with audiovisual media on knowledge level and oral hygiene status of deaf children. Rev Latinoam Hipertens. 2022;17(1).

18. Salikun S, Supriyana S, Suwarsono S. Dental Monitoring Application of Simogi to Change Parental Behavior for Maintaining Children Dental Health. J Kesehat Gigi. 2023;10(1):77–82.

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