Impact of the Android-Based Dental Guard Application on Enhancing Dental Caries Knowledge Among 5th Grade Students at SDN Ngagel 1 Surabaya

Habib Imaduddin Fadhlurrahman[1], Imam Sawro Edi [1], Ratih Larasati [1], and Sunomo Hadi [1], Anshad Ansari [2]

[1]Department of Dental Health, Poltekkes Kemenkes Surabaya, Surabaya, Indonesia
[2]Diploma in Oral Health Therapy, Nanyang Polytechnic, Singapore, Singapore

Corresponding author: Sunomo Hadi (e-mail: sunomohadi@gmail.com)

ABSTRACT Dental caries remain a prevalent oral health issue among school-aged children, significantly impacting their quality of life and academic performance. Despite various health education efforts, knowledge regarding dental caries among elementary students remains limited, necessitating innovative educational interventions. This study aims to evaluate the effectiveness of the Android-based *Dental Guard* application in enhancing dental caries knowledge among 5th grade students at SDN Ngagel 1 Surabaya. A pre-experimental study with a one-group pretest-posttest design was conducted, involving 31 students selected through total sampling. Data were collected using structured questionnaires administered before and after the educational intervention utilizing the *Dental Guard* application. The collected data were analyzed using the Wilcoxon signed-rank test to determine the significance of changes in knowledge levels. The findings revealed a statistically significant improvement in students' knowledge following the intervention, with the pretest scores indicating that 63% of students possessed moderate knowledge and only 27% demonstrated good knowledge. Posttest results showed that 90% of students achieved good knowledge levels, while none remained in the low category. The Wilcoxon test produced a p-value of 0.000 (p < 0.05), confirming the effectiveness of the application in increasing dental caries knowledge. These results suggest that interactive, technology-based learning tools such as the *Dental Guard* application can serve as effective supplementary media in school health education programs. In conclusion, the *Dental Guard* application significantly improved students' understanding of dental caries and offers a promising strategy for health promotion among elementary school children. Future research should explore its long-term impacts and integration into broader oral health education initiatives.

INDEX TERMS dental caries, student knowledge, health education, Android application, Dental Guard

I. INTRODUCTION

Oral health is a fundamental component of general well-being, particularly in children, as it influences essential functions such as eating, speaking, and socializing [1]. However, despite significant advances in health promotion strategies, the prevalence of dental caries among children remains alarmingly high. According to the 2018 Basic Health Research (RISKESDAS), the national caries prevalence in Indonesia was 88.8%, with even higher rates observed among children aged 5–9 years (92.6%) and 10–14 years (73.4%) [9]. Dental caries, if left untreated, can impair chewing ability, cause pain, and reduce concentration, ultimately affecting children's academic and developmental outcomes [10], [20].

Numerous factors contribute to poor oral hygiene, including inadequate knowledge, poor dietary habits, and limited access to dental care [7], [8], [18]. One government initiative to address this issue is the School Dental Health Effort (UKGS), which focuses on promotive, preventive, and curative dental care within school environments [4], [9]. Although the UKGS has proven effective in some contexts, its impact remains inconsistent due to disparities in implementation and reach [5], [18].

With the growing accessibility of digital devices and mobile technology among school-aged children, integrating technology into health education presents a promising approach. Several studies have demonstrated the effectiveness of digital learning tools and mobile applications in enhancing health literacy, especially when designed to be engaging and interactive [15], [23], [24]. Educational applications have shown potential in delivering accessible and personalized learning experiences while fostering behavioral change [14], [22]. Despite these advancements, few applications specifically target dental health education in primary schools,

and even fewer are empirically evaluated for their effectiveness in Indonesia.

This study addresses this gap by examining the impact of the Android-based Dental Guard application, a health promotion tool developed to increase children's knowledge about dental caries through interactive digital media. The aim of this study is to assess the effectiveness of the *Dental Guard* application in improving the level of knowledge about dental caries among 5th-grade students at SDN Ngagel 1 Surabaya.

This study contributes to the field of oral health education in three key ways. First, it provides empirical evidence supporting the integration of mobile-based interventions in school-based dental health programs. Second, it expands the scope of health promotion tools by assessing an application specifically designed for primary school students. Third, it offers a replicable model for combining technology with behavioral science to promote preventive dental care at an early age.

II.   METHODS
A. STUDY DESIGN
This study employed a pre-experimental design using a one-group pretest-posttest approach to evaluate the effectiveness of the Android-based *Dental Guard* application in improving dental caries knowledge among 5th-grade students. This design allowed researchers to measure changes in knowledge before and after the educational intervention without the use of a control group. Such a design is particularly useful in early-phase studies of educational tools [25], [26].

B. STUDY SITE AND DURATION
This study was conducted at SDN Ngagel 1 Surabaya, located at Jl. Ngagel 221-A, Wonokromo District, Surabaya City, East Java Province, Indonesia. The school was selected due to its accessibility, cooperation from the administration, and relevance to the study objectives, particularly the high prevalence of dental caries among its students. The research was carried out over a period of five months, from November 2023 to March 2024, during the 2023/2024 academic year. This timeframe allowed for adequate preparation, implementation of the intervention using the *Dental Guard* application, and administration of both the pretest and posttest to assess the effectiveness of the educational tool. The study duration was determined to ensure consistency in data collection and to accommodate the school's academic schedule.

C. POPULATION AND SAMPLING
The target population in this study consisted of all 5th-grade students enrolled in class 5B at SDN Ngagel 1 Surabaya. Given that the total number of students was relatively small (N = 31), the researchers employed a total sampling technique. This approach was deemed appropriate because the entire population was manageable and could be feasibly included within the study framework. Total sampling is commonly utilized in educational research when the population size is limited, ensuring that every eligible individual is given an equal opportunity to participate and allowing for more comprehensive data representation and analysis [27].

D. INCLUSION AND EXCLUSION CRITERIA

The inclusion criteria were as follows: (1) students enrolled in class 5B during the study period; (2) students who were physically and cognitively able to participate; and (3) students whose parents or guardians provided informed consent. The exclusion criteria consisted of: (1) students absent during either the pretest or posttest sessions; (2) students with speech or learning disorders that could hinder participation in digital interventions.

E. EDUCATIONAL INTERVENTION: DENTAL GUARD APPLICATION
The intervention involved the use of the **Dental Guard** application, a mobile-based educational tool developed for the purpose of increasing awareness of dental caries prevention. The application contains visual animations, interactive content, and gamified elements designed to engage young learners. It delivers key information about causes, symptoms, consequences, and prevention strategies related to dental caries [28].

F. DATA COLLECTION INSTRUMENT AND PROCEDURE
Knowledge assessment was conducted using a structured questionnaire administered before and after the intervention. The questionnaire was developed based on validated items from previous oral health education studies and adjusted to match the cognitive level of primary school students [29]. It consisted of multiple-choice questions focused on definitions, causes, symptoms, prevention, and impacts of dental caries. The pretest was administered prior to the introduction of the Dental Guard application. Following this, students were given time to interact with the application under teacher supervision. Upon completion, a posttest using the same questionnaire was conducted to evaluate changes in knowledge. The pretest-posttest approach ensures that differences in scores can be attributed to the intervention [30].

G. ETHICAL CONSIDERATIONS
Prior to data collection, ethical approval was obtained from the relevant institutional review board. Parental or guardian informed consent was required for all participants, and students were given an explanation of the study's purpose and assured of the confidentiality and voluntary nature of their participation.

H. DATA ANALYSIS
Data were processed and analyzed using the Wilcoxon signed-rank test, a non-parametric statistical test appropriate for paired ordinal data that do not follow a normal distribution [31]. The test was conducted to determine whether there was a statistically significant difference between pretest and posttest scores. Knowledge categories were classified into three levels good, moderate, and poor based on the percentage of correct responses. Descriptive statistics were used to present demographic characteristics, such as age and gender distribution. All statistical analyses were performed using SPSS version 25.0, with a significance level set at $\alpha = 0.05$. A p-value less than 0.05 was considered statistically significant.

III. RESULT
The study involved 31 students of class 5B SDN Ngagel 1 Surabaya, with 30 students as samples, aiming to determine

the effect of the Android-based Dental Guard application on increasing dental caries knowledge. The results of data collection were carried out using a questionnaire sheet instrument that had been filled in by respondents, namely class 5B students of SDN Ngagel 1 Surabaya.

A. AGE CHARACTERISTICS OF STUDENTS IN CLASS 5B SDN NGAGEL 1 SURABAYA

TABEL 1
Frequency distribution of student age at SDN Ngagel 1 Surabaya

Student age	frequency	Percentage (%)
10	18	58
11	13	42
Total	31	100%

According to TABLE 1, the age distribution of students in class 5B at SDN Ngagel 1 Surabaya shows that the majority of students were 10 years old, totaling 18 individuals or 58% of the sample. Meanwhile, 13 students (42%) were aged 11 years. This indicates that the participants generally fall within the typical age range for 5th-grade students in Indonesia, aligning with national educational demographics [27].

B. GENDER CHARACTERISTICS OF STUDENT IN CLASS 5B OF SDN NGAGEL 1 SURABAYA

TABEL 2
Frequency Distribution of Gender of Students of SDN Ngagel 1 Surabaya

Student Gender	Frequency	Percentage (%)
Male	13	42
Female	18	58
Total	31	100%

As presented in TABLE 2, the gender distribution of students reveals a higher proportion of female participants. Out of the total 31 students, 18 (58%) were female and 13 (42%) were male. This gender composition reflects a balanced representation, although slightly dominated by female students. Such distribution is important to note, as gender may influence learning preferences and responsiveness to health education interventions [32].

C. DATA COLLECTION RESULTS

TABEL 3
Recapitulation of the Results of Class 5B Students' Knowledge of Dental Caries Before Using the Dental Guard Application

No	Knowledge criteria	Number of students	Percentage (%)
1	Good	8	27%
2	Enough	19	63%
3	Less	3	10%
	Total	30	100%

Based on TABLE 3 shows that the knowledge of class 5B students at SDN Ngagel 1 Surabaya before using the Dental Guard application was in the sufficient category as many as 19 students (63%) and the rest were in the good and deficient categories. Based on TABLE 4 shows that the knowledge of students aged 11 years has good knowledge criteria as many as 1 student, enough 9 students and less 3 students. The number of students aged 10 years with good criteria is 7 students, enough 10 students and less 0 students. Based on

TABEL 4
Recapitulation of the Results of Class 5B Students' Knowledge of Dental Caries Before Using the Dental Guard Application based on age

No	Knowledge criteria	Number of students		Percentage (%)
		10 Years	11 Years	
1	Good	7	1	27%
2	Enough	10	9	63%
3	Less	0	3	10%
	Total	17	13	100%

TABEL 5
Recapitulation of the Results of Class 5B Students' Knowledge of Dental Caries Before Using the Dental Guard Application based on gender

No	Knowledge criteria	Number of students		Percentage (%)
		Female	Male	
1	Good	4	4	27%
2	Enough	13	6	63%
3	Less	1	2	10%
	Total	18	12	100%

TABEL 6
Recapitulation of the Results of Class 5B Students' Knowledge of Dental Caries After Using the Dental Guard Application

No	Knowledge criteria	Number of students	Percentage (%)
1	Good	27	90%
2	Enough	3	10%
3	Less	0	0%
	Total	30	100%

TABEL 7
Recapitulation of the Results of Class 5B Students' Knowledge of Dental Caries after Using the Dental Guard Application based on age

No	Knowledge criteria	Number of students		Percentage (%)
		10 Years	11 Years	
1	Good	15	12	90%
2	Enough	2	1	10%
3	Less	0	0	0%
	Total	17	13	100%

TABEL 8
Recapitulation of Class 5B Students' Knowledge Results About Dental Caries After Using the Dental Guard Application based on gender

No	Knowledge criteria	Number of students		Percentage (%)
		Female	Male	
1	Good	14	13	90%
2	Enough	3	0	10%
3	Less	0	0	0%
	Total	17	13	100%

TABEL 9
Results of the analysis of the use of the Android-based Dental Guard application on increasing dental caries knowledge of SDN Ngagel 1 Surabaya students

No	Variable	Category			P value
		Good	Medium	Bad	
1	Pre-Test	8	19	3	0.000
2	Post-Test	27	3	0	

TABLE 5 shows that the knowledge of female students has good knowledge criteria as many as 4 students, 13 students and 1 student less. The number of male students with good criteria is 4 students, 6 students are sufficient and 2 students are lacking. Based on TABLE 6, it shows that the knowledge of grade 5B students at SDN Ngagel 1 Surabaya after using the Dental Guard application with a sufficient category of 3 students (10%) and a good category of 27 students (90%). Based on TABLE 7 shows that the knowledge of students aged 11 years has good knowledge criteria as many as 12 students, enough 1 student and less 0 students. The number of students aged 10 years with good criteria is 15 students, 1 student is sufficient and 0 students are lacking. Based on

TABLE.8 shows that the knowledge of female students has good knowledge criteria as many as 14 students, enough 3 students and less 0 students. The number of male students with good criteria was 13 students, 0 students and 0 students.

D. DATA ANALYSIS OF THE USE OF THE ANDROID-BASED DENTAL GUARD APPLICATION ON INCREASING KNOWLEDGE OF DENTAL CARIES OF CLASS 5B STUENTS OF SDN NGAGEL 1 SURABAYA

Based on the data collected through pretest and posttest evaluations regarding dental caries knowledge, the normality test indicated that the data were not normally distributed. Therefore, the Wilcoxon signed-rank test a non-parametric statistical method was applied to assess the effectiveness of the Android-based Dental Guard application. This analysis aimed to determine whether there was a significant difference in students' knowledge before and after using the application. The test was conducted on 5th-grade students of SDN Ngagel 1 Surabaya, and the results provided statistical evidence supporting the application's impact on enhancing dental caries knowledge among the participants.

Based on TABLE 9, Wilcoxon test analysis results, the sig value = 0.000 is obtained, which means it is smaller than $\alpha < 0.05$. This can also be interpreted that the use of the Dental Guard application can increase knowledge about dental caries in class 5B students of SDN Ngagel 1 Surabaya.

VI. DISCUSSION

A. INTERPRETATION OF RESULTS

The findings of this study demonstrate a significant improvement in students' knowledge regarding dental caries following the use of the Android-based Dental Guard application. Prior to the intervention, the majority of students fell into the moderate knowledge category (63%), with only a few demonstrating a high level of understanding. After the intervention, 90% of the participants achieved a good level of knowledge, and no students remained in the low category. The application of the Wilcoxon signed-rank test yielded a significance value of $p = 0.000$ ($p < 0.05$), indicating that the educational intervention had a statistically significant effect.

This improvement in knowledge can be attributed to several factors inherent in the Dental Guard application. The interactive nature of the media, incorporating animations, quizzes, and engaging content, likely contributed to improved comprehension and retention among students. Digital media, particularly those designed with child-friendly interfaces, have been shown to be effective in enhancing knowledge acquisition and motivation in school-age children [32], [33].

Moreover, the design of the application aligns with the cognitive characteristics of elementary school students, who tend to favor concrete, visual, and practical learning formats. According to developmental psychology, children in this age group learn more effectively through play-based and interactive methods rather than traditional didactic instruction [34]. The results suggest that the use of mobile applications like Dental Guard can serve as an effective pedagogical supplement in primary health education, particularly in topics that are not always given prominence in school curricula, such as oral hygiene.

B. COMPARISON WITH SIMILAR STUDIES

The outcomes of this study are consistent with previous research that highlights the effectiveness of digital interventions in promoting health-related knowledge and behaviors among children. For instance, a study by Septianingtyas et al. [35] found that interactive media significantly improved oral hygiene awareness among elementary students. Similarly, the application "Ayo Dedis," which was also developed for Android platforms, showed a substantial increase in knowledge among pregnant women regarding nutrition, reinforcing the potential of digital applications in public health education [36]. Another relevant study by Widodo et al. [37] examined the use of educational games for improving understanding of dental caries and found that game-based learning significantly outperformed traditional lectures in knowledge retention. The gamification elements used in Dental Guard, such as quizzes and rewards, are supported by educational theory as effective mechanisms for sustaining attention and encouraging self-directed learning [38].

Furthermore, the increase in knowledge seen in this study supports the findings of Kusuma and Hidayat [39], who reported that mobile learning applications improved behavioral outcomes in school-based health promotion. These findings also align with international literature, including a systematic review by Schwendicke et al. [40], which concluded that mobile health (mHealth) technologies are effective tools for promoting preventive dental care in various populations, including children. Despite these positive outcomes, it is worth noting that most previous studies have focused either on general health education or older age groups. This study contributes new insights into the impact of mobile-based oral health education specifically targeted at elementary school students, thus addressing a notable gap in the literature.

C. LIMITATIONS AND IMPLICATIONS

While the results of this study are promising, several limitations should be considered when interpreting the findings. First, the study utilized a pre-experimental one-group pretest-posttest design, which does not control for confounding variables such as external exposure to dental health information or the influence of teacher involvement. Without a control group, it is difficult to ascertain whether the observed changes were solely due to the intervention.Second, the sample size was relatively small (n = 31) and drawn from a single class in one school. This limits the generalizability of the findings to broader student populations. Future studies should consider larger and more diverse samples across multiple schools or regions to improve external validity. Third, the study relied on self-administered questionnaires to measure knowledge. Although validated instruments were used, there is the possibility of social desirability bias or misinterpretation of questions among younger students. Incorporating observational assessments or teacher evaluations in future research may provide more comprehensive insights into behavioral changes resulting from the intervention.

Despite these limitations, the study provides valuable implications for public health practice and education. The significant increase in knowledge after using the Dental Guard application highlights the importance of integrating technology into school health programs. As digital literacy

increases among young students, mobile applications offer scalable and cost-effective means of delivering consistent health education messages. In addition, this study underscores the need for collaborative efforts between educators, health professionals, and application developers in designing educational tools that are both informative and engaging. Schools can benefit from incorporating these digital interventions into their regular health curricula, particularly in regions where access to traditional health education resources may be limited. Furthermore, this research supports national strategies aimed at improving oral health among children, such as the Indonesian government's UKGS program. Given the persistently high rates of dental caries in Indonesia [41], tools like *Dental Guard* can serve as effective complements to existing school-based oral health initiatives. Lastly, the findings open avenues for future research and development. Further studies should assess the long-term retention of knowledge and explore whether improved awareness translates into better oral hygiene behaviors. Additionally, developers could enhance the application with interactive features, such as virtual tooth brushing guides or augmented reality experiences, to further engage users and reinforce key messages.

V. CONCLUSION

This study aimed to evaluate the effectiveness of the Android-based *Dental Guard* application in enhancing knowledge about dental caries among 5th-grade students at SDN Ngagel 1 Surabaya. Before the intervention, most students demonstrated a moderate level of knowledge, with only 27% categorized as having good knowledge and 10% in the low category. Following the use of the application, the number of students in the good knowledge category increased substantially to 90%, with no students remaining in the low category. The Wilcoxon signed-rank test indicated a significant difference between pretest and posttest scores ($p = 0.000$), confirming the application's effectiveness in improving student knowledge. The findings suggest that integrating interactive, mobile-based educational tools into school health programs can serve as an effective strategy for promoting oral health awareness among elementary students. As technology continues to evolve, future research is encouraged to explore the long-term behavioral impacts of such applications and expand their features to include interactive learning, gamification, and behavior monitoring. Additionally, the application may be adapted for broader use in other age groups or integrated with school curricula to maximize its educational benefits.

DATA AVAILABILITY

No datasets were generated or analyzed during the current study.

AUTHOR CONTRIBUTION

All authors contributed substantially to the development of this research. Habib Imaduddin Fadhlurrahman was responsible for conceptualizing the study, conducting data collection, implementing the educational intervention, and drafting the initial manuscript. Imam Sarwo Edi provided supervision throughout the research process, contributed to the development of the methodology, and performed statistical analyses. Ratih Larasati supported the validation of research instruments, conducted the literature review, and critically reviewed the manuscript to ensure academic rigor. Sunomo Hadi oversaw the overall project administration, coordinated communication with relevant stakeholders, and provided final revisions and academic guidance. All authors read and approved the final version of the manuscript.

DECLARATIONS

ETHICAL APPROVAL

The study was approved by the ethics committee of the Health Polytechnic of the Ministry of Health Surabaya.

CONSENT FOR PUBLICATION PARTICIPANTS.

Consent for publication was given by all participants.

COMPETING INTERESTS

The authors declare no competing interests.

REFERENCE

[1] J. E. M. Tameon, R. Larasati, and S. Hadi, "Hubungan Pengetahuan Anak Dengan karies Gigi Anak Kelas VA SDI Raden Paku Surabaya Tahun 2020," Jurnal Skala Kesehatan, vol. 1, no. 1, p. 16, 2021.

[2] N. H. Puspita, I. C. Mahirawatie, and R. Larasati, "Media Monopoli Kesehatan Gigi Terhadap Peningkatan Pengetahuan Dan Sikap Pemeliharaan Kebersihan Gigi Dan Mulut," JIKG, vol. 3, no. 2, p. 9, 2022.

[3] N. D. Febria and D. Y. Arinawati, "Penyuluhan dan Pelatihan Kesehatan Gigi dan Mulut pada Masa Pandemi Covid-19," Proc. Seminar Nasional PPM, pp. 659–665, 2021.

[4] A. Y. Gerung et al., "Perilaku Pemeliharaan Kesehatan Gigi Mulut Siswa SD Dengan dan Tanpa UKGS," e-GiGi, vol. 9, no. 2, p. 124, 2021.

[5] R. B. Purnama et al., "Peningkatan Peran Guru Sekolah Dasar Dalam Pengobatan Darurat," JATI EMAS, vol. 5, no. 1, pp. 1–8, 2021.

[6] U. S. Kurniawan et al., "Peningkatan Pengetahuan Kesehatan Gigi dan Mulut Anak," Dental Agromedis, vol. 1, no. 1, pp. 1–7, 2023.

[7] J. S. Milala, "Sistem Pakar Untuk Pendiagnosaan Karies Gigi," Jurnal Teknologi, vol. 4, no. 1, pp. 103–111, 2021.

[8] J. Iyud et al., "Faktor Dominan Penyebab Terjadinya Karies Gigi," Jurnal Biomedik, vol. 7, pp. 20472–20479, 2023.

[9] Kemenkes RI, Pedoman Usaha Kesehatan Gigi Sekolah (UKGS), 2012.

[10] Z. Rehena et al., "Hubungan Pengetahuan dan Kebiasaan Menggosok Gigi," Jurnal Kesehatan, pp. 10–14, 2020.

[11] M. C. Paremeswara and T. Lestari, "Pengaruh Game Online Terhadap Perkembangan Emosi," Jurnal Pendidikan Tambusai, vol. 5, pp. 1473–1481, 2021.

[12] N. Septianti and R. Afiani, "Memahami Karakteristik Siswa Sekolah Dasar," As-Sabiqun, vol. 2, no. 1, pp. 7–17, 2020.

[13] N. W. Mariati, "Pencegahan dan Perawatan Karies Rampan," Jurnal Biomedik, vol. 7, no. 1, 2015.

[14] F. N. Rahma et al., "Pengaruh Pembelajaran Daring di Masa Pandemi," Edukatif, vol. 3, no. 5, pp. 2470–2477, 2021.

[15] L. Sekarwati et al., "Aplikasi Ayo Dedis Untuk Peningkatan Pengetahuan Gizi," Media Husada, vol. 3, no. 2, pp. 132–142, 2022.

[16] S. Notoatmodjo, Promosi Kesehatan & Perilaku Kesehatan, 2014.

[17] N. Husna and P. Prasko, "Efektivitas Penyuluhan Kesehatan Gigi dengan Busy Book," Jurnal Kesehatan Gigi, vol. 6, no. 1, pp. 51–55, 2019.

[18] Marliny et al., "Analisis Pelaksanaan UKGS di Masa Pandemi Covid-19," Jurnal Human Care, vol. 3, no. 6, pp. 541–550, 2021.

[19] N. Afrinis et al., "Faktor yang Berhubungan dengan Karies Gigi Anak Usia Dini," Jurnal Obsesi, vol. 5, no. 1, p. 763, 2020.

[20] A. Putri et al., "Perspektif Orang Tua pada Kesehatan Gigi Anak," Jurnal Obsesi, vol. 3, no. 1, p. 161, 2019.

[21] K. A. K. Wijaya et al., "Peran Guru pada Kegiatan UKGS," JIKG, vol. 3, no. 1, pp. 1–20, 2022.

[22] T. Salfiyadi et al., "Peran Dental Nurse dalam Transformasi Kesehatan," Jurnal Pengabdian Masyarakat, vol. 2, no. 1, pp. 2964–6731, 2023.

[23] Jumriani et al., "Penggunaan Media Audio Visual dalam Kesehatan Gigi," Jurnal Kesehatan Gigi, vol. 21, no. 1, pp. 54–66, 2022.

[24] William and Hita, "Mengukur Tingkat Pemahaman Pelatihan PowerPoint," JSM STMIK Mikroskil, vol. 20, no. 1, pp. 71–80, 2019.

[25] M. Siregar, "Hubungan Antara Pemenuhan Kebutuhan Psikologis Dengan Semangat Kerja Pada Karyawan Bank Mandiri Cabang Balige," Jurnal Diversita, vol. 5, no. 1, pp. 33–36, 2019, doi: 10.31289/diversita.v5i1.2471.

[26] L. Sekarwati, F. Apriyanto, and R. Zunaedi, "Pengaruh Aplikasi Berbasis Android Ayo Dedis Untuk Peningkatan Pengetahuan Gizi Seimbang Terhadap Stunting Pada Ibu Hamil," Media Husada Journal Of Nursing Science, vol. 3, no. 2, pp. 132–142, 2022, doi: 10.33475/mhjns.v3i2.86.

[27] E. Rahmawati, A. Fadhil, and I. Salamah, "Application of Total Sampling in Public Health Research," Jurnal Penelitian Kesehatan Suara Forikes, vol. 13, no. 2, pp. 88–94, 2021.

[28] D. S. Purba et al., "Effectiveness of Android-based Educational Media on Dental Health," Jurnal Kesehatan Gigi, vol. 8, no. 1, pp. 23–30, 2022.

[29] A. S. Putri and M. Rachmawati, "Development and Validation of Oral Health Knowledge Questionnaire for Primary Students," Jurnal Keperawatan Gigi, vol. 7, no. 2, pp. 41–50, 2023.

[30] S. N. Lestari and T. Handayani, "Pretest-Posttest Evaluation in Oral Health Education Programs," Jurnal Promkes, vol. 10, no. 1, pp. 65–70, 2021.

[31] R. Herlina and M. Syafitri, "Application of Wilcoxon Test in Analyzing Non-Parametric Health Data," Jurnal Statistika dan Komputasi, vol. 4, no. 1, pp. 45–50, 2020.

[32] A. K. Dewi and M. F. Pambudi, "Development of Interactive Multimedia Based on Android to Increase Elementary School Students' Interest in Learning," Jurnal Pendidikan Dasar, vol. 13, no. 1, pp. 11–19, 2022.

[33] S. D. Utami and D. Irawan, "Pengaruh Media Interaktif Berbasis Android Terhadap Peningkatan Pengetahuan Siswa Tentang Kesehatan," Jurnal Inovasi Pendidikan Dasar, vol. 6, no. 2, pp. 85–92, 2021.

[34] R. D. Wijayanti et al., "The Role of Interactive Media in Children's Learning Motivation," Jurnal Pendidikan Anak, vol. 7, no. 1, pp. 56–64, 2020.

[35] M. D. Septianingtyas, N. Azizi, and H. D. Arifin, "Pengaruh Penggunaan Media Interaktif terhadap Pengetahuan Siswa tentang Kesehatan Gigi dan Mulut," Jurnal Kesehatan Gigi, vol. 8, no. 1, pp. 25–30, 2021.

[36] L. Sekarwati, F. Apriyanto, and R. Zunaedi, "Pengaruh Aplikasi Berbasis Android Ayo Dedis untuk Peningkatan Pengetahuan Gizi Seimbang terhadap Stunting pada Ibu Hamil," Media Husada J. Nurs. Sci., vol. 3, no. 2, pp. 132–142, 2022, doi: 10.33475/mhjns.v3i2.86.

[37] B. S. Widodo, R. Nurwahyuni, and D. Y. Handayani, "The Effectiveness of Dental Education Game in Improving Children's Knowledge about Dental Caries," J. Med. Health Educ., vol. 4, no. 3, pp. 45–52, 2022.

[38] Y. Prasetyo and I. Harliantara, "Gamification in Health Education: A Case Study on Elementary School Students," J. Edukasi dan Teknologi Pembelajaran, vol. 2, no. 2, pp. 90–97, 2020.

[39] A. Kusuma and T. Hidayat, "Mobile Learning untuk Meningkatkan Perilaku Hidup Sehat di Sekolah Dasar," Jurnal Teknologi Pendidikan, vol. 8, no. 1, pp. 45–52, 2021.

[40] F. Schwendicke et al., "Mobile Apps for Oral Health Promotion: A Review of Content, Quality, and Potential Impact," J. Dent. Res., vol. 99, no. 12, pp. 1407–1413, 2020.

[41] Kementerian Kesehatan RI, Profil Kesehatan Indonesia Tahun 2022, Jakarta: Kemenkes RI, 2023.