

Early Detection and Intervention of Preschool-Aged Children Using Android-Based Monitoring during the COVID-19 Pandemic in Central Java

Triwijji Lestari*, Elisa

Nursing Department, Politeknik Kesehatan Kemenkes Semarang, Semarang 50268, Indonesia

*E-mail: triwijilestari68@gmail.com

Abstract

Preschool age is widely recognized as a critical phase in child development, often referred to as the golden period, the window of opportunity, and the critical period. Alarming statistics from the Indonesian Ministry of Health reveal that 16% of Indonesian toddlers, amounting to 0.4 million children, experience developmental delays, encompassing fine and gross motor skills, hearing impairments, reduced cognitive abilities, and speech delays. This study aims to assess the effectiveness of an Android-based early detection and intervention system on the development of preschool children during the challenging circumstances of the COVID-19 pandemic in Central Java. The research employed a quasi-experimental design without a control group using a range of instruments, including observation sheets, the Sahabat Bunda application, the pre-screening developmental questionnaire (PDQ), and anthropometric measurements. Data analysis was conducted using the Wilcoxon test because the data were not normally distributed. The study's results underscore a significant influence between the initial developmental status of children and their subsequent progress following developmental intervention, with a remarkable p-value of 0.001. In conclusion, this research demonstrates that providing developmental intervention positively impacts the overall development of preschool children. This study substantially benefits the community, specifically preschool-age children and their parents. The utilization of the Sahabat Bunda application emerges as a valuable tool for early detection of developmental issues and to foster the growth of preschool-age children. This research contributes to enhancing child development, particularly in the context of the COVID-19 pandemic.

Keywords: android, early detection of development, preschool

Abstrak

Deteksi dan Intervensi Dini Anak Usia Prasekolah Menggunakan Pemantauan Berbasis Android pada Masa Pandemi COVID-19 di Jawa Tengah. Usia prasekolah umumnya diakui sebagai fase kritis dalam perkembangan anak, sering disebut sebagai periode emas, jendela kesempatan, dan periode kritis. Data statistik yang dari Kementerian Kesehatan Indonesia mengungkapkan bahwa 16% dari anak-anak balita Indonesia, sekitar 0,4 juta anak, mengalami keterlambatan perkembangan, mencakup keterlambatan keterampilan motorik halus dan kasar, gangguan pendengaran, kemampuan kognitif yang berkurang, dan keterlambatan bicara. Penelitian ini bertujuan untuk menilai efektivitas sistem deteksi dini dan intervensi berbasis Android terhadap pertumbuhan dan perkembangan anak usia prasekolah selama situasi sulit pandemi COVID-19 di Jawa Tengah. Desain penelitian ini adalah quasi-experimental tanpa kelompok kontrol menggunakan berbagai alat, termasuk lembar observasi, aplikasi Sahabat Bunda, Pre-Screening Developmental Questionnaire (PDQ), dan pengukuran antropometri. Analisis data dilakukan menggunakan uji Wilcoxon dikarenakan data tidak terdistribusi secara normal. Hasil penelitian ini menunjukkan pengaruh signifikan antara status perkembangan awal anak-anak dan kemajuan mereka selama intervensi perkembangan, dengan nilai p 0,001. Secara keseluruhan, penelitian ini menunjukkan bahwa pemberian intervensi perkembangan berdampak positif pada perkembangan anak usia prasekolah. Penelitian ini sangat bermanfaat bagi masyarakat, khususnya anak-anak usia prasekolah dan orang tua mereka. Penggunaan aplikasi Sahabat Bunda muncul sebagai alat berharga untuk mendeteksi dini masalah perkembangan dan memfasilitasi pertumbuhan anak-anak usia prasekolah. Penelitian ini berkontribusi pada peningkatan perkembangan anak, terutama dalam konteks pandemi COVID-19.

Kata Kunci: android, deteksi dini perkembangan, prasekolah

Introduction

The process of development is an unavoidable journey throughout human life, marking a significant transformation in both the structure and function of the body, along with cognitive and social abilities. During the initial stages of life, especially in early childhood, this journey lays the groundwork for optimal growth. During this period, children find themselves in what is often referred to as the golden period, where each moment is viewed as a valuable window of opportunity and a critical period in shaping the foundational aspects of their development, with enduring consequences (Ministry of Health Republic Indonesia, 2016). The Ministry of Health Indonesia reported that 0.4 million (16%) Indonesian children under five had developmental disorders, including fine and gross motor development, hearing loss, poor intelligence, and speech delays. All problems in the development of preschool-age children must be detected early, allowing interventions to be carried out without more severe and permanent effects (Chesney, 2013).

Early detection and intervention (EDI) is a comprehensive and quality guideline developed by the Ministry of Health of the Republic of Indonesia to be used as a tool in assisting health professionals in monitoring children's development through stimulation, detection, and early intervention of child developmental deviations. In the EDI book, early detection instruments used the pre-screening developmental questionnaire (PDQ) method. The PDQ is a tool or device used to determine whether a child's development is normal or whether there are deviations. Proper stimulation is needed to stimulate the brain so that the development of movement, speech and language skills, socialization, and independence in toddlers is optimal according to their age (Saurina, 2016). The PDQ should be completed periodically to determine whether a child's development is expected. For infants, which are children from birth up to 1 year old, monitoring is expected to be carried out monthly. In the age range of 12–36 months, moni-

toring is carried out every three months, while in the field of 36–72 months, monitoring is carried out every six months. Currently, the implementation of the EDI program, especially the PDQ, has yet to run optimally. The low awareness of parents in monitoring and early stimulation of children's development is one of the contributing factors (Ministry of Health Republic Indonesia, 2016).

The results of a preliminary study in kindergartens for research purposes in five cities found that out of 100 parents who had preschool-aged children in kindergarten, 42 admitted that they did not understand how to stimulate or measure children's development. Some parents even acknowledged that they did not know that there was a unique stimulation to help children achieve outcomes at certain stages according to their age. Another factor that causes the non-optimal implementation of the EDI program is health workers. Implementation and documentation, which, until now, are still paper-based, have resulted in the reluctance of officers to implement and report on the early detection of deviations in child development (Apriningrum et al., 2018).

The development of information technology is currently increasing. One of the most famous is smartphones, especially Android-based smartphones. According to the Central Statistics Agency (*Badan Pusat Statistik* [BPS]) report, there was an increase in mobile phone usage in Indonesia from 2011 to 2021. In 2021, approximately 65.87% of the population in Indonesia owned mobile phones, marking an increase of around 68% compared to the conditions a decade ago. In 2011, only about 39.19% of the Indonesian population had a mobile phone (BPS, 2022). Thus, Android-based smartphones can be used as one of the right solutions to obtain easy access to the information needed. The development of information technology has also penetrated the health sector. One proof of the development of information technology in the health sector is the existence of mobile health (mHealth) (Källander et al., 2013). mHealth is

a portable electronic device that provides health services and manages patient information.

The primary aim of this study was to empower parents by enabling them to swiftly identify and access information related to the development of their preschool-aged children. Preschoolers frequently use smartphones for recreational purposes, which may introduce more challenges than benefits. Nevertheless, this smartphone-integrated application presents an innovative approach, delivering content explicitly designed to stimulate the development of young children. The games within the application serve a dual purpose, seamlessly blending entertainment and educational elements to foster the development of preschoolers. Moreover, the application incorporates a growth monitoring feature. In cases where early detection reveals irregularities in a child's growth, the application can swiftly identify these issues and provide recommendations for early interventions. The adaptable nature of this application enables it to actively support and enhance the development of preschool-aged children, accessible at any time and anywhere. This study aims to determine the effectiveness of implementing early detection and intervention of preschool-aged children's development based on Android for monitoring the development of children during the COVID-19 period in Central Java.

Methods

The research design was a quasi-experiment using a nonequivalent pre- and post-test method without a control group. This research was conducted by the researchers from April to November 2021, and that ethically approved by ethical number No. 075/A.1-S1/FIK-SA/II/2022 Department of Nursing, Universitas Islam Sultan Agung. Data collection took place from July to September 2021.

The sampling technique employed was nonprobability sampling with a purposive sampling approach. Respondents meeting the inclusion criteria, totaling 100 children, were selected

according to the stipulated conditions, with 20 children in each city being the research locations, namely Semarang, Blora, Pekalongan, Purwokerto, and Tegal. All the respondents received the same treatment, involving detection and developmental intervention in the form of stimulation for gross motor skills, fine motor skills, language, and social behavior in preschool-age children. The intervention was administered four times over a two-week period using the Sahabat Bunda (SABU) application through smartphones.

The researcher conducted measurements on 100 children, consistent with the total number of respondents. No dropouts were observed during the study. The characteristics presented in this research include the gender and age of the children. Furthermore, the study presented the results of developmental measurements before and after providing developmental stimulation interventions for each respondent. Inclusion criteria in this study included preschool-age children (4–5 years), the mother had an Android-based smartphone, and the mother and child could operate an Android-based smartphone independently. The exclusion criteria were children with developmental disorders (autism, etc.).

The research instrument used was an observation sheet containing information on monitoring the implementation of treatment. The primary interventions in this study were the use of the EDI application on smartphones, the PDQ, the weight and height measurement tool, and standard operating procedures for applying SABU. This study's univariate analysis of respondents' demographic data was presented using frequency and percentage distributions. Then, bivariate analysis was continued using the Wilcoxon test because the data were not normally distributed.

Results

The demographic characteristics of the respondents observed in this study were the sex of the

Table 1. Frequency Distribution of Respondents Based on the Demographics of Children

Demographics	n	%
Gender		
Male	48	48
Female	52	52
Age		
4 Years	47	47
5 Years	40	40
6 Years	13	13
Total	100	100

Table 2. Children’s Development Levels Before and After Intervention with Wilcoxon Test Results

Development Level	Pre-test n (%)	Post-test n (%)	Asymp Significance (2-tailed)
Appropriate	47 (47)	83 (83)	0.001
Doubtful	39 (39)	17 (17)	
Deviation	14 (14)	0 (0)	
Total	100 (100)	100 (100)	

child and age. Based on Table 1, the data show that more girls were involved in this study (52%) compared to boys, and almost half of the respondents were aged 4 years (47%).

According to Table 2, 47% of the children had appropriate development levels before the intervention, and after the intervention 83% of children had appropriate development level. The statistical test confirmed that there was a significant difference in the proportion of the children’s developmental levels before and after the intervention.

Discussion

A significant value of 0.001 was obtained by comparing the level of child development before and after the developmental intervention. This indicates a statistically significant influence because the significance value is less than 0.05. Based on the analysis conducted, it can be concluded that there is a statistically significant effect between the two variables.

Although the overall effect was good, 17% of the children showed uncertain developmental growth following the administration of deve-

lopmental stimulation. Despite receiving detection and stimulation therapies, these children exhibited deficits at different stages of development. The observed developmental irregularities were treated in accordance with the PDQ recommendations through the SABU program, which can be easily accessed on cell phones owned by parents or kindergarten teachers. This highlights the significance of ongoing and personalized interventions to guarantee good growth in youngsters who may not be receptive to generic stimulation methods.

Efforts must be made by children’s mothers to prevent developmental disorders by providing stimulation at every opportunity to interact with the surrounding environment so that children’s development follows their age. Efforts must also be made by health service agencies, health centers, and health workers to prevent child development disorders by providing information on child development through training and counseling to mothers who have children.

The handling that must be done for children with deviant or doubtful categories is through early detection, which can be done at all health-care facilities. The examination consists of the

detection of deviations in child development using the PDQ to determine whether the child's development is normal according to the child's age, contained in the SABU. After the screening test, children found with deviant development were stimulated regularly. Stimulation carried out on children is adjusted to the stages of developmental delays experienced by children following the guidelines in the SABU application.

Meanwhile, research conducted by Cahyono (2017) states that there is no significant relationship between parental stimulation and toddler-age children's social development. This can happen because parents with good knowledge of inspiration only sometimes provide stimulation to their children due to various factors. This is unfortunate because stimulation plays an essential role in child development. Another study showed a relationship between giving parental stimulation and language development in preschool-age children (Yektiningsih et al., 2017). This highlights the significance of parental involvement in fostering specific aspects of a child's development. The contrasting results between studies emphasize the nuanced nature of parental influence on child development, indicating that the impact may vary depending on the specific developmental domain under consideration.

A lack of stimulation can lead to developmental delays in children. Most children with developmental delays are identified at preschool or school age, making it difficult for them to develop their potential. Developmental delays often occur in early childhood in Indonesia. Child development involves multiple facets, including gross motor, fine motor, language, cognitive, personal, and social skills. Developmental delays in children arise when a child fails to reach the anticipated milestones in one or more of these areas within a specific age range. These delays are impacted by various factors, such as socioeconomic, maternal, biological, environmental, nutritional, and genetic influences, among others (Bishwokarma et al.,

2022). Research conducted by Andriyani et al. (2023) regarding the pattern of developmental delays in rural and urban children in Garuda Public Health Center Bandung revealed that 21 out of 173 examined children experienced developmental delays (12.1%). A comparable ratio was observed in rural areas, where 22 children exhibited developmental delays out of the 173 children examined (12.7%). This highlights the universality of developmental delays and emphasizes the need for targeted interventions across diverse socioeconomic and geographical contexts.

The persistent challenge in Indonesia is the ongoing enhancement of child development awareness and comprehension. Previous work has shown that the prevalence of developmental delays in Indonesia is significantly influenced by parental understanding, attitudes, and monitoring methods (Andriyani et al., 2023; Bishwokarma et al., 2022). This study highlights the critical role of parents in promoting infant development, as demonstrated by the encouraging findings achieved through parental engagement using the SABU application.

The significance of parents comprehending the stages of child development extends beyond the physical and mental well-being of the child; it also carries substantial implications for the child's future. Children with developmental delays may have challenges in all areas of life, impacting their academic performance and complicating their adaptation to educational curricula, which is consistent with prior research that emphasizes the lasting impact of early developmental deficits on scholastic and social outcomes (Anggraini, 2017; Martorell, 2017).

Insufficient parental information and supervision can hinder the early detection of developmental abnormalities in children. This study's findings highlight the necessity for customized educational programs and training for parents, focusing on effective techniques to oversee and enhance child development. These findings align with research indicating that enhanced

parental comprehension can improve developmental outcomes (Hasanah et al., 2019).

The importance of early detection and intervention transcends cognitive and academic issues, including social and emotional aspects. Children with developmental delays frequently encounter difficulties in establishing social connections, adjusting to educational settings, and regulating emotional issues (Bishwokarma et al., 2022). This study emphasizes the efficacy of combining technical solutions, such as the SABU application, with community-based help to tackle these complex difficulties.

Comprehensive educational programs are essential for improving parental understanding and involvement. Such activities must encompass educational institutions, healthcare facilities, and community organizations, as shown in a previous study (Källander et al., 2013). Moreover, cooperative initiatives between the government and pertinent institutions might facilitate the establishment of policies that endorse a comprehensive approach to child development.

This study mitigates developmental abnormalities by addressing parental knowledge and ability constraints. Incorporating tools such as the SABU application alongside tailored educational and therapeutic programs guarantees that each child has an equal opportunity to realize their potential and confront future problems confidently.

Conclusion

Based on the research data, with a p-value of 0.001, it can be conclusively stated that a significant influence exists between the level of child development before receiving developmental intervention and their developmental progress afterward. This research significantly benefits the community, particularly preschool-age children and their parents. The utilization of the SABU application emerges as a valuable tool for early detection of child development issues and to effectively stimulate the develop-

ment of preschool-age children. Addressing obstacles associated with parental knowledge and understanding, coupled with enhancing monitoring skills, endeavors seek to diminish unclear developmental statistics and alleviate the consequences of substantial developmental irregularities in Indonesia. These endeavors guarantee that every child possesses a fair chance to realize their potential and confront the future with assurance.

Acknowledgements

The authors would like to thank all those who helped in this research, especially the respondents who are willing to be research materials spread across five cities including Semarang, Blora, Pekalongan, Purwokerto, and Tegal for allowing us to conduct research in their place. This research is also supported and funded by the Poltekkes Kemenkes Semarang.

References

- Andriyani, R., Fadlyana, E., & Tarigan, R. (2023). Factors affecting the developmental status of children aged 6 months to 2 years in urban and rural areas. *Children*, 10 (7), 1214. doi: 10.3390/children10071214.
- Anggraini, D. (2017). *Pengaruh stimulasi perkembangan dengan pencapaian perkembangan motorik anak usia 1-3 tahun di Playgroup Kelurahan Pandean Kota Madiun* [Undergraduate thesis, STIKES Bhakti Husada Mulia Madiun]. Retrieved from: <http://repository.stikes-bhm.ac.id/183/>
- Apriningrum, N., Carudin, C., & Rahayu, M.A. (2018). Rancang bangun aplikasi M-Chat berbasis android bagi anak balita di Kabupaten Karawang. *Berita Kedokteran Masyarakat*, 34 (11). doi: 10.22146/bkm.40504.
- Badan Pusat Statistik (BPS). (2022). *Statistik telekomunikasi Indonesia 2021*. Retrieved from: <https://www.bps.go.id/id/publication/2022/09/07/bcc820e694c537ed3ec131b9/statistik-telekomunikasi-indonesia-2021.html>

- Bishwokarma, A., Shrestha, D., Bhujel, K., Chand, N., Adhikari, L., Kaphle, M., Wagle, A., & Karmacharya, I. (2022). Developmental delay and its associated factors among children under five years in urban slums of Nepal. *PLoS One*, 17 (2), e0263105. doi: 10.1371/journal.pone.0263105.
- Cahyono, A.D. (2017). Pengaruh stimulasi orang tua terhadap perkembangan sosial anak usia toddler. *Jurnal Akademi Keperawatan Pamenang (AKP)*, 5 (1).
- Chesney, R.W. (2013). The disappearance of diseases, conditions, and disorders of childhood. *Journal of Pediatrics*, 162 (5), 903–905. doi: 10.1016/j.jpeds.2012.11.088.
- Hasanah, M.N., Rachmawati, D.A., & Efendi, E. (2019). The correlation between mother's knowledge about language stimulation and language development of toddlers in Lengkong, Mumbulsari, Jember. *Journal of Agromedicine and Medical Sciences*, 5 (3), 167–171. doi: 10.19184/ams.v5i3.9628.
- Källander, K., Tibenderana, J.K., Akpogheneta, O.J., Strachan, D.L., Hill, Z., Asbroek, A.H.A.T., Conteh, L., Kirkwood, B.R., & Meek, S.R. (2013). Mobile health (mhealth) approaches and lessons for increased performance and retention of community health workers in low- and middle-income countries: A review. *Journal of Medical Internet Research*, 15 (1), e17. doi: 10.2196/jmir.2130.
- Martorell, R. (2017). Improved nutrition in the first 1000 days and adult human capital and health. *American Journal of Human Biology*, 29 (2), 1–24. doi: 10.1002/ajhb.22952.
- Ministry of Health Republic Indonesia. (2016). *Pedoman pelaksanaan: Stimulasi, deteksi dan intervensi dini tumbuh kembang anak di tingkat pelayanan kesehatan dasar*. Kementerian Kesehatan RI. Retrieved from: <https://www.library.stikesbup.ac.id/index.php?p=fstream-pdf&fid=203&bid=2481>
- Saurina, N. (2016). Aplikasi deteksi dini tumbuh kembang anak usia nol hingga enam tahun berbasis android. *Jurnal Buana Informatika*, 7 (1), 65–74. doi: 10.24002/jbi.v7i1.485.
- Yektiningsih, E., Martiningsih, M., & Mukayaroh, A (2017). Hubungan pemberian stimulasi oleh orang tua dengan perkembangan bahasa pada anak usia pra sekolah (3-5 tahun) di Taman Kanak-kanak Al-Fath Pare. *Jurnal Akademi Keperawatan Pamenang (AKP)*, 1 (2).