Effectiveness of Android-Based Application (Nosting) for Early Detection of Stunting and Growth and Development Screening in Children Aged 12-24 Months

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ABSTRACT: In general, data from height and weight measurements are manually entered into a growth chart, where this process takes time and can result in stunting cases being missed during the data entry process. Therefore, an early detection system was developed by utilizing the sophistication of Android which is currently widely used by the community. The purpose of this research is to build an innovative application for early detection of stunting and growth and development screening in children aged 12-24 months so that it can make it easier to monitor their growth and development based on Z-Score and KPSP. This research method is R&D. The research model used is ADDIE. This study used 43 respondents and 3 expert respondents. The sampling technique used purposive sampling. The results of the study based on the assessment of 3 experts get a value of 79.67% with a category worth using and based on a small scale trial on 43 respondents on the assessment of the effectiveness of the application getting a value of 89% so that it can be categorized as very effective. It can be concluded that the application of early detection of stunting and growth and development screening is feasible and very effective to use.

KEYWORDS: Android, Application, Early Detection, Growth and Development, Stunting.

INTRODUCTION

Stunting is a growth disorder that occurs due to malnutrition that lasts for a long time, namely in the first thousand days of life (1000 HPK) where it is a critical period because it has permanent and irreversible effects (Hijrawati *et al.*, 2021). Stunting is a condition when children under the age of five have a length or height condition that is less than their age when measured using a Z-score value of more than minus two standard deviations (Laksono *et al.*, 2022). Nutritional needs, especially in the fetal and infant period, are fundamental to the development of cognitive, motor, and socioeconomic abilities throughout childhood and adulthood (Shrestha *et al.*, 2022).

Child stunting is one of the most significant barriers to human development, globally affecting an estimated 162 million children under 5 years of age (Friska and Andriani, 2022). Children aged 18-35 months and 36-59 months have a higher risk of stunting (Roba *et al.*, 2021). Stunting in children that occurs in the short term can cause cognitive, motor, verbal decline, increased morbidity and even mortality due to infection, increased risk of perinatal and neonatal mortality, increased risk of chronic disease in adulthood, and poor child development (Handayani dkk. 2019). Stunting can increase the risk of experiencing developmental delays and contracting non-communicable diseases later in life (Sari and Sartika, 2021). Stunting that occurs in the first 2 years of life is associated with cognitive deficits in late adolescence (Nahar *et al.*, 2020).

Stunting in children, especially toddlers, has short- and long-term impacts, including increased morbidity and mortality, poor child motor development and poor learning capacity, increased risk of infection and non-communicable diseases in adulthood, and decreased productivity and economic ability mortality (Beal *et al.*, 2018). The importance of determining the right time to provide interventions for stunting development in children, namely by focusing on the first 1000 days or before the age of 24 months (Kang and Kim, 2019). Reducing child stunting is the first of the six goals of the 2025 Global Goals with a 40% reduction target (WHO, 2014). Tackling child stunting remains the government's main commitment, as affirmed in Indonesia's Medium-Term Development Goals 2015-2019 and 2020-2024 (Mulyaningsih *et al.*, 2021).

For children, parents and caregivers are important in early detection of abnormalities and stimulation to support their health(Areemit *et al.*, 2020). One important step to ensure that children have the opportunity to thrive and reach their optimal developmental potential is to conduct regular monitoring to enable early identification of children who are experiencing barriers to

development so that timely referrals can be made for intervention (Bhavnani *et al.*, 2021). In general, data from height and weight measurements are manually entered into growth charts, which is time-consuming and can result in cases being missed during the data entry process (Dunkel *et al.*, 2021). In many countries, growth charts are part of child welfare books and are used to provide access to understandable information (Patel *et al.*, 2019). Growth charts play an important role in helping parents see their child's growth at a glance. The utilization of technology to monitor children's growth and development is necessary. The emergence of smart phones and mobile devices has the potential to facilitate the use of technology in monitoring such as applications (Langarizadeh *et al.*, 2021).

The use of android for health interventions has the potential to reach a large population, utilize internet access to search for information, and use the latest science for health decision making as a primary option (Vanderloo *et al.*, 2021). In 2021, about 80% of the world's population has access to smartphones and the percentage of internet users worldwide reached 59.5% of the global population (Kustiawan *et al.*, 2022). A total of 92.6% of mobile device users accessing the intern shows that mobile applications can be accessed by anyone (Seyyedi *et al.*, 2020). This provides an opportunity to make healthcare accessible to a wider population (González-Pérez *et al.*, 2023). Various apps have been developed and can be easily installed from app stores, which can handle a variety of personal, entertainment, and business needs (Miralles *et al.*, 2020). In order to make it easier to monitor children's growth and development, researchers developed an android-based application, namely Nosting. The purpose of this research is to test the feasibility and effectiveness of the application that has been developed. Both applications that are used independently and those designed to be recommended by practitioners require end-user validation to minimize the risk of ineffective application use (Muro-Culebras *et al.*, 2021).

METHODS

This study is a Research and Development study, using the ADDIE research model, namely Analysis, Design, Development, Implementation, and Evaluation. This research was conducted in July 2023 in Kempleng Village which is the working area of Puskesmas Sumberjo, Kediri. This research uses 2 types of respondents, namely expert respondents and small-scale test respondents. Expert respondents required 3 disciplines, namely IT experts, doctors, and nutritionists. As for the small-scale test respondents, the population used was all mothers in Kempleng Village with a research sample of some mothers who met the inclusion criteria. The inclusion criteria are mothers who have android at least version 5, mothers who can operate android, and mothers who have children aged 12-24 months. Calculation of sample size using the Slovin formula and obtained as many as 43 mothers. Furthermore, respondents will be given instructions on using the Nosting application. Furthermore, respondents were given a questionnaire sheet. To test the feasibility of the application used an ISO 9126 questionnaire filled in by expert respondents, while to test the effectiveness of using an effectiveness questionnaire filled in by small-scale test respondents.

RESULTS AND DISCUSSION

I. *Respondent Characteristics*

The general characteristics of expert respondents and small-scale test respondents include age and occupation

Table 1. Respondent Characteristics

No.	General Characters	Variables	Frequency	Percentage
1	**Age**	<20 years	0	**0**
		20-35 years	40	**87%**
		>35 years	6	**13%**
Total			46	**100%**
2	**Work**	Not working	32	**69,5%**
		Working	14	**30,5%**
Total			46	**100%**

Based on the table above, it can be seen that the respondents of this study were 46 respondents. At the age of the respondents, 3 groupings were made with almost all respondents aged 20-35 years as many as 40 respondents (87%) and a

small proportion of respondents were in the age range> 35 years, namely 6 respondents (13%). Characteristics of respondents based on occupation most respondents did not work as many as 32 respondents (69%).

II. *Application Design*

Nosting stands for No Stunting. Nosting is an application designed with the aim of helping to monitor the growth and development of toddlers. Nosting is an application or tool that contains instruments for measuring stunting based on Z-Score and developmental screening based on KPSP. The existence of this tool is expected that mothers can monitor the growth and development of their toddlers independently. This application has a simple display that can be easily used by mothers. The use of an internet connection is only required to access the information available in the application.

Mobile apps are used to support pediatric healthcare interventions (DeWitt *et al.*, 2022). Automated growth monitoring, where algorithms are integrated into electronic health records, is more efficient than standard growth monitoring, with higher referral rates to specialists and higher diagnostic yields of growth disorders (Fernandez-Luque *et al.*, 2020). Each time the user enters data, the application uses an automated growth monitoring strategy that incorporates scientifically-mathematically validated algorithms to predict measurements (De Arriba Munõz *et al.*, 2022).


Picture 1. Login

In this section, the user enters data in the form of email and password, if both inputs are registered, the user can access the features of the application.


Picture 2. Register

If the user does not have an account, then this system has a register feature on the login page. For new users, it is necessary to register first. In the registration process, users need to input data such as name, date of birth, gender, address, telephone number, email and password.
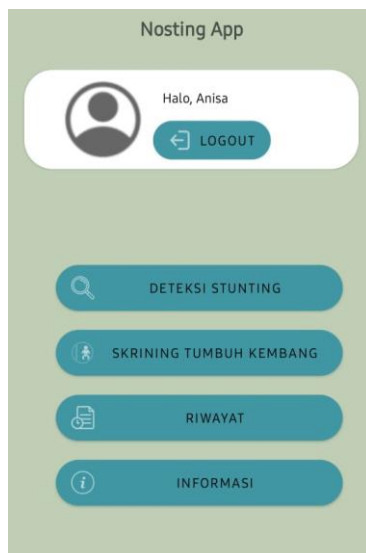

Picture 3. Main Page

After the user has successfully logged in, the system will display the main page. The main page displays access in the form of stunting detection, growth and development screening, history and information.
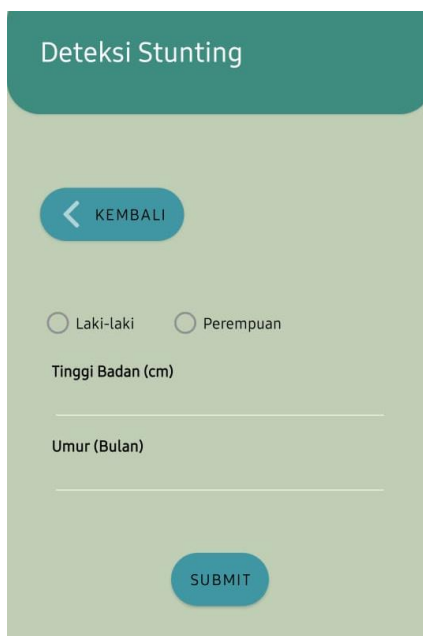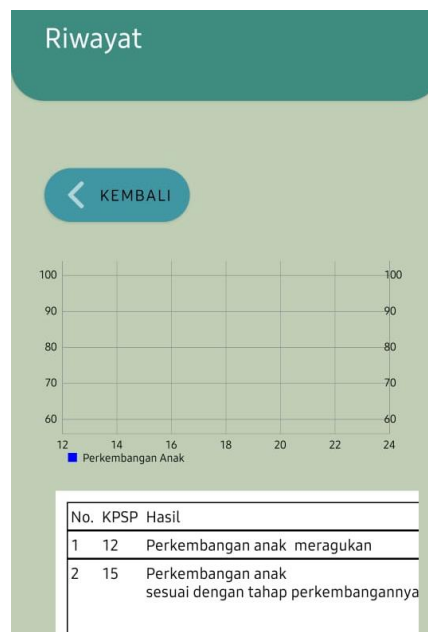

Picture 4. Stunting Detection

If the user selects the stunting detection menu, the user will be shown a page as drawn. On this page the user needs to enter data in the form of height and age to be entered into the system.
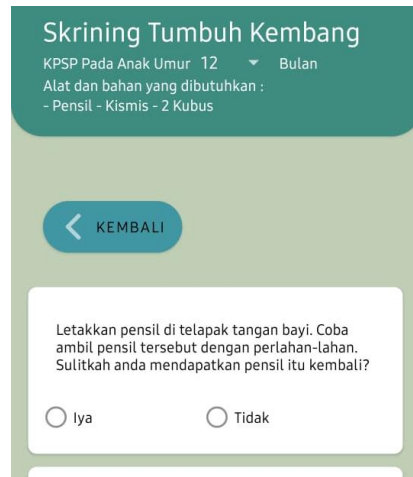
Picture 5. Growth and Development Screening

On the growth and development screening page, the system will display a page like the one beside. On this page the user will be asked questions from the system to detect children's growth and development screening.

Picture 6. History

The history page displays the results of stunting detection and child development screening based on the data and questions that have been answered by the user on the previous pages.
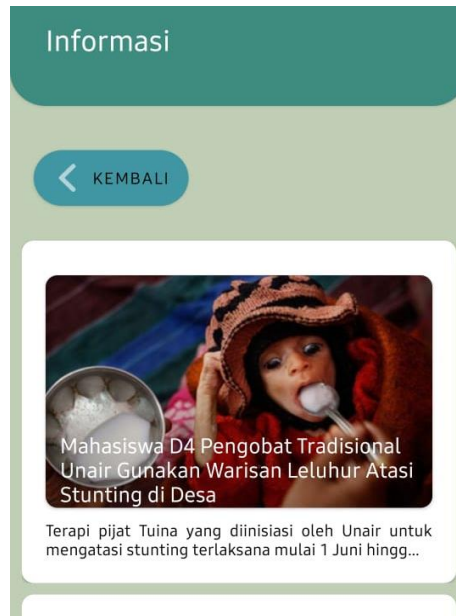
Picture 7. Information

On the information menu, a page containing information about stunting and child development will be displayed.

III. *Feasibility Test*

Application system feasibility is the process of analyzing application systems that focus on the results of user and system interactions (Syamranata, Witjaksono and Suputra, 2019). The feasibility of an application system has several usability principles, namely, navigation, response time, credibility, and content (Kristiani, Primasari and Irianto, 2022). There are four dimensions of system feasibility, namely navigation, ease of use, response time, and security (Ahmadi and Mohammadi, 2023). ISO 9126 is a software quality characteristics model used to discuss, plan, and evaluate the quality of software products (Sanjaya, Andry and Fernandes Andry, 2021). This model consists of six characteristics namely, functionality, reliability, usability, efficiency, maintainability, and portability (Perdomo and Zapata, 2021). It includes measures to quantify the achievable level of each product quality attribute (Wang *et al.*, 2019).

In order to determine the feasibility of the new application, it is necessary to test with a standardized theory, namely by using the ISO 9126 model software feasibility theory (Stellata *et al.*, 2022). ISO 9126 is a standard used to determine the quality of internationally recognized software (Banjarnahor, Darwiyanto and Suwawi, 2018). The ISO 9126 model has 6 aspects, namely functionally, reliability, usability, efficiency, and portability (Andry, Suroso and Bernanda, 2018). Each aspect has its own sub-aspects (Cercetare-dezvoltare *et al.*, 2018). There are 3 experts who are used as validators of stunting detection and growth and development screening applications in children aged 12-24 months, namely doctors, IT experts, and nutritionists.

Table 2. Frequency of ISO 9126 questionnaire responses

Aspects	N	%
Functionally	3	76
Reliability	3	63
Usability	3	85
Efficiency	3	84
Maintainability	3	83
Portability	3	87
Total Average Expert Feasibility Score = 79,67%		

The ISO 9126 standard standard has several aspects, namely functionally, reliability, usability, efficiency, maintainability, and portability (Alfarisi, 2019). Based on the assessment of the three experts, the Functionally value is 76%, Reliability 63%, Usability 85%, Efficiency 84%, Maintainability 83%, Portability 87%. Obtained a total expert assessment score of 79.67% so that it can be classified that the application of early detection of stunting and growth and development screening in children aged 12-24 months is feasible to use.

The results of similar research conducted by Nurlailiah (2022) obtained a usability value of 80.5%, reliability 79.2%, functionally 77%, efficiency 75%, maintability 100%, and portability 75%, with a total expert feasibility value of 81.25%, it can be said that the application is very feasible to use (Nurlailiah 2022).

IV. *Small Scale Test Results*

In order to determine the effectiveness of the stunting detection and growth and development screening application, five indicators of effectiveness measurement put forward by Merwe and Bekker in Dewanti (2017) are used, namely Interface, Navigation, Content, Reliability, Technical, and Quality (Dewanti, 2017). Measurement of the perceived use of the stunting early detection and growth screening system (Nosting) aims to see the extent of the application's effectiveness in conducting early detection of stunting and growth screening.

Table 3. Effectiveness test results of each aspect

Aspects	N	%
Interface	46	89
Navigation	46	88
Content	46	89
Reliability	46	88
Technical	46	91
Total Average Expert Feasibility Score = 89,00%		

Based on table 3. shows the results of the small-scale test analysis of the effectiveness of the application, with scores on each aspect, namely :

1. Interface

    This aspect is very important to increase interest in using and accessing an application. The Interface aspect obtained a score of 89%, where it can be said that the interface aspect is very effective to use. This is in line with previous research where the interface spec obtained a score of 86%, including in the very effective category (Jannah, 2018).

2. Navigation

    The navigation aspect serves to clearly describe the relationship of all elements in the application. The navigation aspect obtained a score of 88%, where it can be said that the navigation aspect is very effective to use. This is in line with previous research where the navigation spec obtained a score of 86.5%, including in the very effective category (Jannah, 2018).

3. Content

    The content aspect is an indicator that discusses the information provided in the application and can be presented through text, documents, animations, images, sounds, and so on. The content aspect obtained a score of 89%, where it can be said that the content aspect is very effective to use. This is in line with previous research where the content spec obtained a score of 86%, including in the very effective category (Jannah, 2018).

4. Reliability

    The reliability aspect is an indicator in which this aspect discusses the accuracy and accuracy of procedures that are used continuously. The reliability aspect obtained a score of 88%, where it can be said that the reliability aspect is very effective to use. This is in line with previous research where the content spec obtained a score of 85.6%, including in the very effective category (Jannah, 2018).

5. Technical

The technical aspect is an indicator that contains the technical aspects that need to be considered in the application so that it can run its function properly. The technical aspect obtained a score of 91%, where it can be said that the technical aspect is very effective to use. This is in line with previous research where the content spec obtained a score of 66%, including in the effective category (Jannah, 2018).

The average score in the effectiveness test is 89.00%, it can be concluded that the application for early detection of stunting and growth and development in children aged 12-24 months is in the effective category. So that this application has the potential to be accepted and useful to support parents in monitoring growth and development in their children. Previous research states that digitizing growth charts and embedding them into android applications is an acceptable modality and may be preferred by parents and guardians to record and monitor their child's growth (Humphrey *et al.*, 2021).

CONCLUSION

Based on the results of the research that has been carried out, it can be concluded that the Nosting application is feasible to use and very effective for early detection of stunting and growth and development screening in children aged 12-24 months. Therefore, the Nosting application can be used as a consideration to facilitate parents in monitoring the growth and development of their children.

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