

## Original Research Article

# The design of growth and development children's monitoring application: a user-centered approach

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**Received:** 04 October 2022

**Accepted:** 03 November 2022

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## ABSTRACT

**Background:** Due to pandemic COVID-19, integrated health services post (Posyandu) was disrupted affecting child growth monitoring. A minimum monitoring approach for the health of children is required. The objective of this study was to design a growth and development children's monitoring application.

**Methods:** We applied research and development methods to define and design the app. The Focus Group Discussion (FGD) was conducted to identify user need, including storyboards, content, features, flow, and performance of android application. We also collaborate with technology information expertise to design an app. The research was carried out in Yogyakarta from May to June 2021.

**Results:** The result showed that users needed a comprehensive app based on Android with a minimum data storage space including growth and child development monitoring, considering storyboard design, menu interface, nutritional and developmental children's milestones, interpretation, and recommendation. The growth monitoring interface includes identity, a child's health history, and anthropometry, while the development monitoring interface contains stimulation and the child's developmental achievement. We also provide interpretation and recommendations according to children's health.

**Conclusions:** As a conclusion, we indicate that by following the proposed user-centered framework, we successfully design android applications to monitor growth and development in children, namely DEPA 2.1, abbreviation of design and development of anthropometry and development children's applications.

**Keywords:** Design, Development, m-Health, Children, Growth, User-centered

## INTRODUCTION

Health is a fundamental factor to build superior human resources in advanced Indonesia.<sup>1</sup> Investment in maternal and child health will provide benefits of 48 times compared to health investment in the future.<sup>2</sup> Anthropometric or body composition and developmental children measurements are the essential indicators for growth, health and children well-being.<sup>3</sup> Indonesia faces triple burden of malnutrition, there are under-nutrition (stunting, wasting, micronutrient deficiency), over-nutrition (obesity), and non-

communicable diseases such as Diabetes Mellitus (DM), hypertension, stroke, and other blood vessels.<sup>4,5</sup>

Anthropometric measurement routinely is important to detect growth failure.<sup>6</sup> It is widely accepted and strongly supported by health professionals, and as a standard component of community paediatric services throughout the world.<sup>7</sup> The main aspects of body measurement are body weight, body height or body length, head circumference, middle up arm circumference (MUAC), and its combination.<sup>6</sup> Thus, the government has through

the Minister of Health Republic Indonesia No. 2 of 2020, issued anthropometric guidelines/standards.<sup>8</sup> This regulation aims to monitor children's growth optimally so provide quality human resources. The anthropometric measurement have 4 indices, there are HAZ, WAZ, WHZ, BMI, which must be used as a reference for health workers, program managers, and relevant stakeholders for the assessment of children's nutritional status and child growth trends<sup>8</sup>. Monitoring the development of children is also essential due to the close connection between growth impairment and delayed development.<sup>9</sup> In the era of the industrial revolution 4.0, the smart phone is the primary needs. In 2016, it was reported that there were 65.2 million people, and in 2019 it rose 150% to 90 million. It is estimated that the number of smartphone users will continue to increase. In Indonesia in 2019, as many as 63.53% of people use smartphones.<sup>10</sup> And now, smart phone users continue to increase from year to year.<sup>11</sup>

In the health sector, smart phone technology is used to provide better services for the community, monitor health, save resources and as a means of health promotion. Smartphones have become a part of our daily life. This device makes it possible to create many alternative tasks based on the internet, provides opportunities for easy interconnection, access to the news or journal all sectors including health promotion or treating patients<sup>12,14,15</sup>. In addition, smart phones have increasing computing power and multimedia capabilities, making them ideal software for professional development in the health sector.<sup>15,16</sup> User-centered design involves the end user in every step of the design process. This helps the designer make a product that is as useful as possible. A nutritionist as a health professional really needs the right data and information to support nutrition service decisions. The use of smart phones that are increasingly common is very beneficial for providing practical guidance to health professionals, thereby reducing local resources and providing great benefit.<sup>17-19</sup> To support nutrition monitoring children for maternal, cadre, early children teacher, and health programmer it is necessary to create an innovative, attractive, in accordance with the existing regulations smart phone application. The application for the smart phone is developed in stages, including the defining and designing phases. This project attempts to establish and construct an application for children's growth and development through user-centered approach.

## METHODS

### *Study design*

This was a mixed-method using qualitative study and research development. Qualitative research supports stage defining, which is a stage to find out user needs in terms of growth and development monitoring applications based on user-centered. Meanwhile, research and development for stage design, namely creating application designs according to user needs.

### *Setting and timing*

Research was conducted in Yogyakarta, Indonesia in May to June 2021 in Yogyakarta.

### *Participants*

Participants were selected by criteria including health programming, early children teacher, and cadres. As many as 18 people served as key informants in this study, including nutritionists, midwives, cadres, early children teachers, and psychologists. We also bring in 3 people with knowledge of information technology (IT) to build applications for stage design. These people were chosen based on their experience building applications.

### *Procedures*

This research was conducted through the stages of study literature, observation of similar applications that already exist in the play store, discussions of the research team, FGD with stake holders to explore needs and meet user-centered, transcription and analyzing, inviting and collaborating with IT experts to design dashboards, features, languages, symbols, colours, and application functions.

### *Analysis*

In a qualitative analysis of the defined design, we looked at information about several themes, such as the possibility of using Android apps to make it easier to track children's growth and development; user needs and stakeholders that should be met by the app; target users; the app's expected benefits; the sources or references used to make the app; the app's expected output; the app's benefits.

### *Ethical consideration*

This research was granted by the IRB of UNISA Yogyakarta on April 17<sup>th</sup>, 2021, no 1767/KEP-UNISA/N/2021.

## RESULTS

### *Subject characteristics*

Subject of FGD as many as 18 participant, most of them were nutritionist (6 persons) and female (13 persons), as detail Table 1.

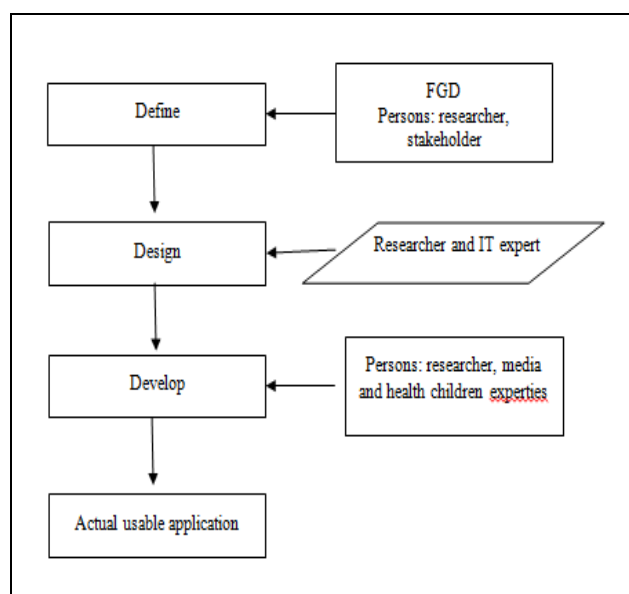
### *Frame-work theory*

We use the 4D theory, which consists of define, design, develop, and disseminate, as a simple depicted Figure 1.

In this study, we present some of the stages of making an application, including the defining and designing stages.

**Table 1: Subject characteristics.**

Characteristics	N
<b>Profession</b>	
Nutritionist	6
Midwifery	3
Cadre	2
Early children teacher	5
Psychologist	2
<b>Sex</b>	
Male	5
Female	13

**Figure 1: Frame-work theory.**

### The defining stage

Presently, it is determined how the user will describe his demands through this application. We conducted FGD to investigate: (a) what difficulties exist in Posyandu activities that can be addressed by this android app?; (b) what is a user or stakeholder's need for this android app?; (c) who is the recommended target user for this android app?; (d) what are the predicted benefits of this android app?; (e) what resources/preferences should be utilized to compile this application?; (f) what is this application's expected output?; (g) has a comparable application existed in the past?; (h) is it feasible to construct this android application?; (i) what goals do you have for this Android app?

We describe users opinion below: in the aspect of monitoring a child's health problems, they stated that

*“The problem is the absence of monitoring the growth and development of toddlers, either because of restrictions on mobilization during the pandemic COVID-19 or because of toddlers' not coming to the Posyandu. It is better if the application can be used by participants independently,*

*entering the results of the Posyandu inspection themselves or carried out by officers as a means for recording and reporting” (Informant D). They stated as representation of their necessity: “What is needed in an android application is to monitor growth and development comprehensively in one application so that we don't log in to different applications every time. The application should have interpretations and recommendations” (Informant I).*

*“The Posyandu android application is expected to have 2 user options, namely participant users and organiser users. So can choose whether he is the organiser or a participant in the Posyandu” (Informant K). Users have expectations of the benefits of a complete information application, including recommendations as they stated:*

*“We need feedback on measurement results and this can be used as a self-surveillance method for toddlers... Data from previous activities can be recorded. The results of the measurement have immediately shown feedback is this normal or not, malnourish or well-nourish, as well as feedback and recommendation for developmental children aspects” (Informant N).*

*“The android application is expected to accommodate the Posyandu programme for growth, development, and feeding of toddlers. Applications need to be developed using the most recent rules” (Informant D). In terms of problems that usually arise in similar applications, these are: “The application is not specific, only focuses on data output, does not fulfilled user needs, the appearance is not beautiful or attractive, the application is too heavy or updated too often. As I know several m-health applications launched... but the app get bad response, it can be data storage consuming, not comprehensive, or not user-centered.” (Informant N).*

In general, we found that users have high hopes that this application will prove useful in the event of a pandemic and possibly in other situations as well. Not only does it make it easier for officers to monitor the growth and development of toddlers, but it also relieves them of some of the burdens they face in terms of time, man power, and other resources.

The application's target users are mothers of toddlers, cadres, health workers, and early children teacher. They hope to anticipate the most favourable outcomes as a result of this application because it was designed to cover and support man power, including expansion and development; it also features an appealing colour scheme; the amount of data storage space it needs is kept to a minimum; and finally, they have high hopes for the application's efficiency.

It is strongly suggested that ministry of health no 2 of 2020 and the MCH book of 2020, both of which are referenced standard, be utilized as the basis for the design of the application. App should be easier for maternal to possibly participate in their children self-surveillance. The existing

application are out of dated because it is based on a regulation that was issued by the Minister of Health in 2010. We also fixing design application included features, login pages, registration page, growth and development aspect, results, interpretation, recommendations, and follow-up.

### The design stage

In brief, we describe the design stage as Figure 2. During the design phase, the concept for the application content was designed. We recruited technology and information experts. The application design was prepared by considering the anthropometric and child developmental standards. The application includes a main and a dashboard section. The main applications consist of: login page, registration, home, growth, development, results, and recommendation. This application can be used as a multi-user, that are mother, cadre, early education teacher, and public health officer. This design application can be downloaded at <https://depa21.com/>. As detail despicied in Figure 3.

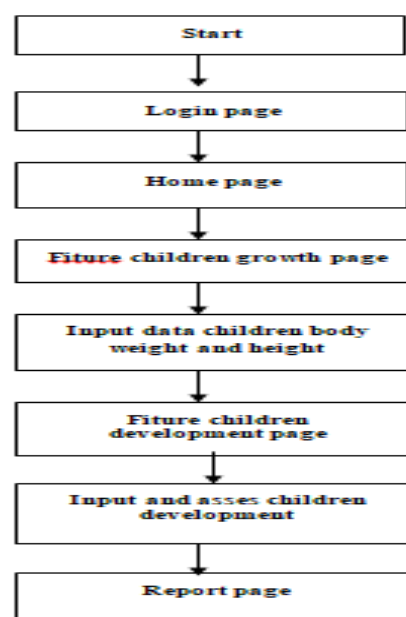


Figure 2: Design of the app.

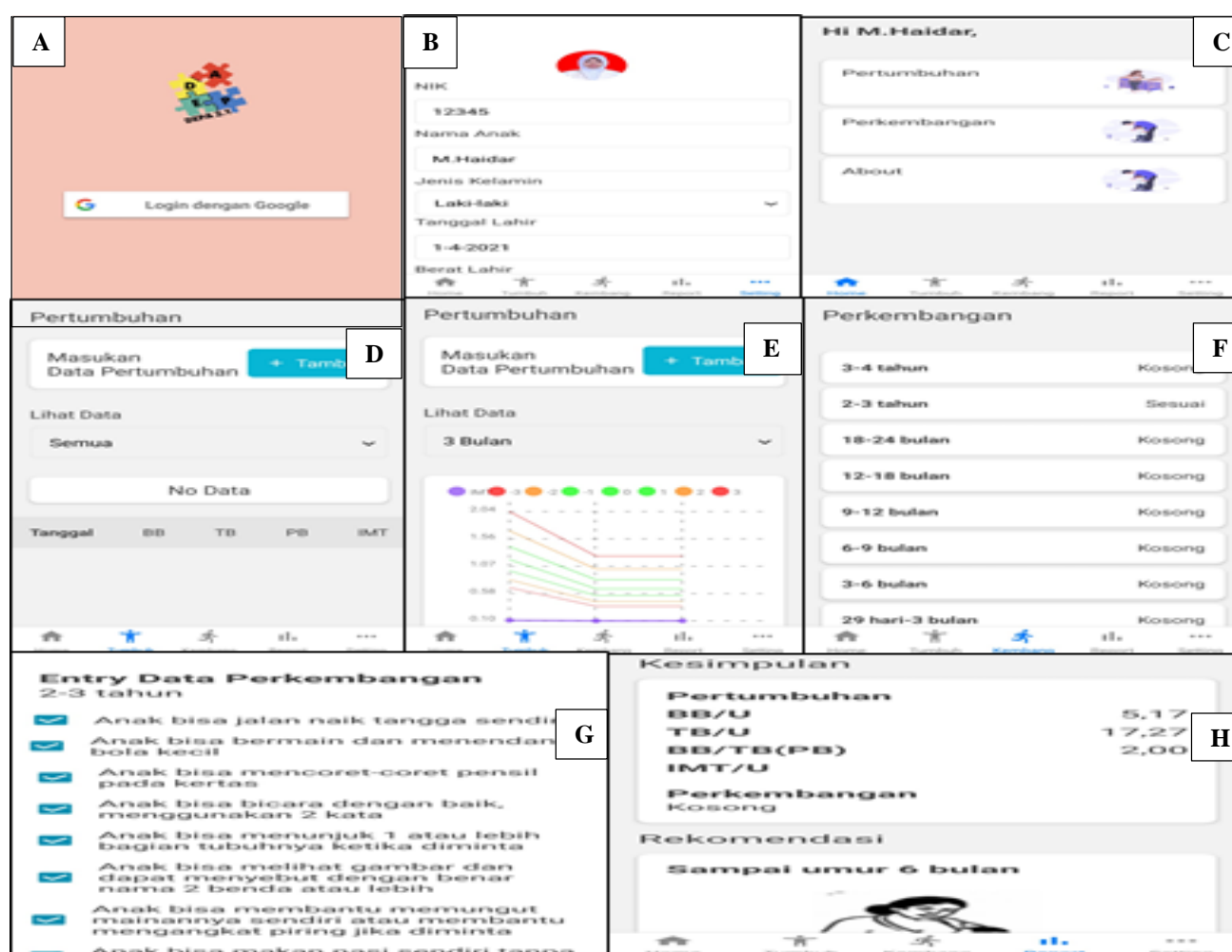


Figure 3: Fiture and dashboard of DEPA application (A) login page, use active e-mail address; (B) registration page (setting); (C) home page; (D) fiture children's growth page; (E) input data: children's body weight and height; (F) Input data: child's development; (G) Asses children's development; and (H) report page.



## DISCUSSION

The COVID-19 pandemic had an impact on all aspects of life, including children's health.<sup>20,21</sup> In Indonesia, the pandemic COVID-19 also affected the growth monitoring regularly.<sup>22</sup> Most of the Posyandu also stop providing child growth monitoring as an effort to restrict people's mobilization and prevent crowds in the context of controlling and preventing the transmission of COVID-19.<sup>21</sup> So it may increase the severity of child malnutrition or add new cases.<sup>23</sup> This DEPA app is very possible to anticipate that the disturbances in health systems brought about by the COVID-19 pandemic will continue to make all types of malnutrition worse. It also reveals the needs of stakeholders regarding monitoring the growth and development of children during the pandemic, as well as developing unique products needed to complement the existing surveillance system using smart phone.<sup>10</sup>

This is one of the appropriate options to continue monitoring the health of children under five during a similar outbreak where population mobility is restricted. This application can provide benefits for mothers as self-monitoring, health service providers to reduce burden and increase effectiveness, early childhood education for monitoring, and support school accreditation. The DEPA application is synergistic with aspects to detect early malnutrition, prevent and control delayed child development based on the updated regulations.<sup>8</sup> This application strongly supports technological advances and innovation in the health sector for the advancement of public health, prioritizing website technology, being paperless, user-friendly, and causing no harm. The DEPA meets novelty criteria due to its comprehensive growth and development monitoring based on the updated regulations.

At the literacy point of view, this application teach mother for caring children, empowering skill mothers on growth and development children monitoring, supporting the performance of cadres and health providers in reporting children growth monitoring, encourage early children teacher accreditation. In addition, this application provides economic benefits to the community and state by lowering the amount of time required to analyze children growth and development milestone, and follow-up according to expert advice. A number of user-based technological innovations have also been developed to help people overcome eating disorders, obesity and binge eating as well as dental care for children.<sup>24-27</sup>

It is hoped that this application would boost user interest and be adopted by the government as one of the acceptable applications for monitoring children's growth and development because it produces high-quality visual photographs that are frequently used in the health sector.<sup>17</sup> In this work, we demonstrate how designing services to fit into stakeholders' existing patterns and routines can guarantee that services are relevant and suit their requirements, thereby enhancing engagement and clinical impact.

## Limitation

Although the storage space used for the installation of this application is small, only an Android users take advantage of the application to monitor the growth and development of toddlers, while IOS users do not able to reach it. However, the application need on internet access

## CONCLUSION

The findings reported that by adhering to the user-centered approach we can successfully create application growth and development children monitoring, namely DEPA.

## ACKNOWLEDGEMENTS

The researchers would like to extend their gratitude to everyone who volunteered to take part in this investigation.

*Funding: No funding sources*

*Conflict of interest: None declared*

*Ethical approval: The study was approved by the Institutional Ethics Committee*

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**Cite this article as:** Siswati T, Nurhidayat, Tjaronosari, Widyawati HE, Rialihanto MP. The design of growth and development children's monitoring application: a user-centered approach. *Int J Community Med Public Health* 2022;9:4399-404.