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DEVELOPMENT OF A WHATSAPP CHATBOT AS A NUTRITION EDUCATION MEDIA FOR MOTHERS OF TODDLERS

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Abstrak*: The Quran commands Muslims to contemplate the signs of Allah in the creation of the heavens and the earth. This includes an understanding of nutrition and dietary practices, enabling mothers to provide healthy and nutritious food for toddlers. The dissemination of reliable information, especially health-related information, has become a significant concern during the Covid-19 pandemic. The objective of this research is to create a WhatsApp chatbot that can serve as a useful and efficient tool for providing essential nutrition information to mothers of toddlers. The research method employed by the researcher is the Prototype Model research method. Prototyping is an approach in software development that involves creating a physical model of a system that can function and represent an initial version of the system under development. The prototyping method is used to generate a system prototype that acts as a bridge between developers and users, allowing them to interact during the information system development process. The research results indicate that the access to nutrition information still relies on conventional methods like lectures and guidebooks for dissemination, which have not significantly impacted the prevention of stunting. Therefore, the development of a WhatsApp chatbot is highly necessary. The researcher has utilized the Human-Computer Interaction (HCI) theory and materials with the characteristics of the 1000 HPK theory as a foundation for developing the WhatsApp chatbot. This research will serve as a valuable tool for accessing nutrition information that can be accessed anytime and anywhere.*

Keywords: *Learning Media, Maternal and Child Health, Nutrition, Stunting*

INTRODUCTION

In Islam, education is considered an obligation for every Muslim, both men and women. The Quran itself emphasizes the importance of knowledge and learning in many of its verses. One of these verses is the saying of Allah (SWT) in Surah Al-Imran (3:190): "Indeed, in the creation of the heavens and the earth, and the alternation of the night and the day, there are signs for those of understanding. "Nutrition education for mothers of toddlers plays a central role in improving the quality of family life. The Quran instructs the Muslim community to reflect upon the signs of Allah in the creation of the heavens and the earth as a form of essential knowledge. This includes knowledge about nutrition and dietary practices, enabling mothers of toddlers to provide healthy and nutritious food for their children.

In addition to the Quran, the hadith of the Prophet Muhammad (peace be upon him) stating that "Seeking knowledge is obligatory for every Muslim" underscores the importance of lifelong learning in Islam. Nutrition education enables mothers of toddlers to understand the principles of nutrition that align with religious teachings, allowing them to provide healthy food in accordance with Islamic values to their families. Therefore, nutrition education is not only a practical necessity but also a religious responsibility that promotes the well-being of families, the healthy development of children, and the fulfillment of religious obligations in maintaining the health and nutrition of their families.

The dissemination of reliable information, especially health-related information, has become a separate issue during the COVID-19 pandemic. The fluctuating volume of information across various media, especially on social media, has created challenges for some individuals in determining the actions they should take because they find it difficult to distinguish between false and accurate information.[1] Chatbots have become an intriguing topic in the field of technology.[2] In general, a chatbot is a computer program capable of performing tasks automatically and operates through messaging platforms, communicating with users using natural human language, ready to assist anytime and

[1] Muhammad Nazrul Islam and A. K. M. Najmul Islam, 'A Systematic Review of the Digital Interventions for Fighting COVID-19: The Bangladesh Perspective', *IEEE Access*, 8 (2020), 114078–87 <https://doi.org/10.1109/ACCESS.2020.3002445>.

[2] Luminița Nicolescu and Monica Teodora Tudorache, 'Human-Computer Interaction in Customer Service: The Experience with AI Chatbots—A Systematic Literature Review', *Electronics*, 11.10 (2022), 1579 <https://doi.org/10.3390/electronics11101579>.

anywhere. Nowadays, with the advancement of artificial intelligence, chatbots are utilized in various fields, such as automated phone response systems, educational support, business, e-commerce, primary virtual assistants, and entertainment.[3]

Previous research has indicated that the development of the internet and online learning has created opportunities for teaching and learning activities that are not restricted by location and time. Online learning (e-learning) and conventional or classical learning tend to have similar effectiveness, but online learning offers advantages in terms of flexibility.

The advancements in technology and online learning have not only influenced the learning environment in general but have also brought about changes in the way we communicate. One application that reflects this transformation is WhatsApp. As a highly popular messaging platform, WhatsApp is utilized not only for social communication but also plays a role in the development of online education. In 2023, We Are Social conducted research on social media usage and found that WhatsApp is the most favored messaging application.[4] The utilization of WhatsApp in the context of online learning harnesses the flexibility identified in previous research. This provides opportunities for communication and learning without being restricted by time and physical location, aligning with the expanding landscape of online education. Within the realm of WhatsApp, features like WhatsApp chatbots enable more interactive communication automation, granting users the ability to use their time more efficiently in online learning. The implementation of automation in WhatsApp is achieved by employing WhatsApp chatbots, which function by processing incoming messages according to predefined program flows. [5]

In this context, the importance of utilizing technology, such as WhatsApp chatbots, to support nutritional education cannot be overlooked. By involving this technology, we can provide easily accessible, personalized, and reliable nutritional information to mothers of toddlers, with the hope of assisting them in making better nutritional decisions for their health and that of their families. According to Prasanti (2022) in her book titled

[3] Moechammad Sarosa and others, 'Implementasi Chatbot Pembelajaran Bahasa Inggris Menggunakan Media Sosial', *JEPIN (Jurnal Edukasi Dan Penelitian Informatika)*, 2020.

[4] https://datareportal.com/social-media-users, 'GLOBAL SOCIAL MEDIA STATISTICS', *DataReportal – Global Digital Insights*, 2023.

[5] Khairil Hamdi Budi Harto Haddad Sammir, 'Whatsapp Chatbot Autoresponder Berbasis Pencarian Artikel', *Prosiding Seminar Nasional Sistem Informasi Dan Teknologi (SISFOTEK) Ke 7 Tahun 2023*, 2023.

"Stunting in Children," in 2017, approximately 151 million (22%) children under the age of five experienced stunting.[6] Based on an article written by Qonita Rachmah (2020), previous research concluded that nutritional education has a significant impact on improving maternal knowledge about preventing stunting during the golden period of child development. The availability of regular nutritional education programs by nutrition officers at health centers and by integrated health post cadres is an important step in preventing stunting.

Accurate nutritional information also provides guidance on the quantity and frequency of food consumption needed to meet children's nutritional needs.[7] With good knowledge of nutrition, parents can plan a balanced and adequate diet for their children, thus preventing inadequate nutrient intake that can lead to stunting. Maternal knowledge of nutrition is one of the factors associated with stunting in children. [8]

In the context of previous research, an essential question emerged regarding whether the development of a WhatsApp chatbot as a nutritional education media for mothers of toddlers is worthwhile. Over the past few years, previous studies have revealed that WhatsApp chatbots have reliable potential for personal and interactive interactions. Furthermore, effective nutritional education can have a positive impact on preventing stunting by increasing the knowledge of mothers about the importance of nutrition in the growth of their children. Therefore, the conclusion that can be drawn from this research is that the development of a WhatsApp chatbot as a nutritional education media for mothers of toddlers is a worthwhile and important approach in supporting the health of children and mothers.

The research method employed by the researcher is the Prototype Model research method. According to Ogedebe and colleagues (2012), they explain that prototyping is an approach in software development that involves creating a physical model of a system that can function and represent the initial version of the system being developed. The prototyping method is used to generate a system prototype that serves as a bridge

[6] Tri Siswati, *STUNTING PADA ANAK* (researchgate.net, 2022).
[7] Nova Dwi Yanti, Feni Betriana, and Imelda Rahmayunia Kartika, 'Faktor Penyebab Stunting Pada Anak: Tinjauan Literatur', *REAL in Nursing Journal*, 3.1 (2020), 1 <https://doi.org/10.32883/rnj.v3i1.447>.
[8] Dini Suhartini and Yunita Rahma, 'Pemanfaatan Aplikasi Pan-Duan Gizi Makanan Sebagai Media Pengontrol Gizi Balita Untuk Pencegahan Stunting Di Usia Dini Pada Kelurahan Tegallega', *Journal of Social Sciences and Technology for Community Ser-Vice (JSSTCS)*, 4.1 (2023).

between developers and users, allowing them to interact during the process of information system development.[9]

According to Ogedebe (2012), the prototyping process begins with gathering requirements involving developers and system users in determining the goals, functions, and operational needs of the system being built. The stages in the prototyping method include:

1. Need Analysis
2. Design Process
3. Prototype Development
4. Evaluation and Improvement.

RESULTS AND DISCUSSION

This study aims to develop and evaluate the use of WhatsApp chatbot as a medium for educating mothers about nutrition for toddlers. The method used in this research is a prototype model that involves four key stages: requirement gathering, a rapid design process, prototype creation, and evaluation and improvement.

Research Result

Need Analysis

In the first stage, which is the requirement gathering, the researcher conducted interviews and surveys with the Village Midwives and mothers of toddlers as potential users of this WhatsApp chatbot. The results of this stage helped us in understanding the needs and preferences of the users, which served as the foundation for the development of the chatbot.

The initial requirement gathering was conducted by the researcher with the Village Midwives through interviews regarding the access to nutrition information in Lengkong Village. Based on the interviews with the Village Midwives in Lengkong Village, information related to nutrition is typically conveyed through the Posyandu for toddlers, the Posyandu for the elderly, and the maternal health classes. The primary sources of information used by mothers in Lengkong Village to learn about nutrition are through oral communication and the KIA (Mother and Child Health) book. The only available

[9] & Jacob, B.P. Ogedebe P.M., 'Software Prototyping: A Strategy to Use When User Lacks Data Processing Experience', *ARPN Journal of Systems and Software. VOL. 2, NO.6 , 2012*, 2012.

health service that can be accessed by the community is through the Posyandu. Regarding awareness and understanding of the importance of balanced nutrition for the growth and development of children, the responses from the mothers are generally positive. However, there is a lack of practical application in daily life, as the information is often heard but not consistently implemented. The challenge in obtaining accurate and reliable nutrition information in Lengkong Village is the limited access to nutrition information. There is difficulty in ensuring whether the KIA book has been read and utilized to its fullest potential, even though it contains a wealth of useful information. The level of participation and interaction among mothers in seeking nutrition-related information is relatively low.

Mothers in Lengkong Village express the desire for better access to nutrition information, especially through more easily accessible media for mothers with toddlers. Currently, the level of accessibility to nutrition information in Lengkong Village is considered quite easy. There is no significant difference in access to nutrition information between mothers living in the central part of the village and those in remote areas of Lengkong Village, as there are two Posyandu facilities, one in the Main area and one in the suburb area. Efforts to improve access to nutrition information in Lengkong Village have been made through simulations during Posyandu sessions. The second phase of requirement gathering was conducted by the researchers through the distribution of questionnaires to mothers with toddlers to assess the access to nutrition information in Lengkong Village. The questionnaire results showed that the majority of mothers in Lengkong Village do not frequently study nutrition, with 85% of the respondents disagreeing and only 5% agreeing. Additionally, the questionnaire results also indicated that all respondents agreed that Posyandu is the only access to nutrition information in Lengkong Village, with 100% of the mothers never seeking nutrition information from other sources besides Posyandu.

When asked whether it is easy to obtain nutrition information other than from Posyandu, 75% of the respondents disagreed, 20% somewhat disagreed, and only 5% agreed. This indicates that the majority of mothers face difficulties in obtaining accurate and reliable nutrition information outside of Posyandu. Furthermore, the questionnaire results also revealed that the majority of mothers in Lengkong Village are aware of the importance of various nutrition-related information. All respondents agreed that information about stunting, exclusive breastfeeding, the benefits of breastfeeding,

complementary feeding (MP-ASI), providing diverse and nutritious supplementary food, as well as cleanliness and sanitation, is important. This shows that mothers in Lengkong Village have a high awareness of the importance of nutrition information for the growth and development of their children.

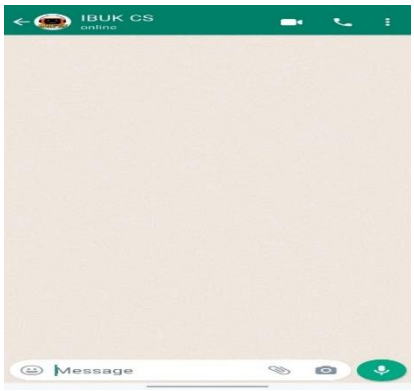
The third phase of needs collection involved distributing questionnaires to mothers regarding the potential of a chatbot as a nutrition information access point in Lengkong Village. The results of the conducted survey showed that the majority of respondents, 90%, claimed to be familiar with chatbots. They also agreed that chatbots can serve as easily accessible sources of nutrition information, with 90% in agreement. Furthermore, 90% of the respondents expressed interest in using a chatbot as a means to access nutrition information in Lengkong Village. Moreover, all respondents (100%) admitted to frequently using instant messaging applications like WhatsApp for communication or seeking information. When asked whether they agree that chatbots can provide relevant nutrition information tailored to the needs of their toddlers, 90% of the respondents agreed, while 10% disagreed. Respondents also concurred that chatbots should respond promptly, with 90% in agreement. Additionally, 90% of the respondents also agreed that chatbots should be accessible anytime, anywhere. Furthermore, the majority of respondents (90%) also agreed that chatbots should provide more personalized and interactive responses. The survey results indicate a strong interest from mothers in Lengkong Village in using chatbots as an easily accessible and interactive means of accessing nutrition information.

Design

The second stage is the design process. This design process is based on the results of the prior Needs Collection conducted by the researcher. The findings from the needs collection provide valuable insights into what users expect and what is needed in the development of the WhatsApp chatbot as an educational tool for nutrition information. This information serves as the primary foundation for designing the chatbot's structure, determining the type of educational content to be provided, and planning the user interface that will ensure the chatbot can effectively meet the users' needs and preferences. Therefore, our WhatsApp chatbot design process will be more efficient and relevant to users' expectations and needs. The researcher designs the structure of the WhatsApp chatbot, identifies the types of educational content to be provided, and plans

the user interface. This process is carried out swiftly to ensure that we can proceed to the next phase promptly.

Table 1
Storyboard Chatbot Whatsapp

No	Picture	Explanation
1		Initial Display 1. Menu Home 2. Icon Whatsapp
2		Initial Display Whatsapp
3		dispaly Room chat Whatsapp

The integration of the WhatsApp chatbot into the WhatsApp application is a crucial step in developing innovative nutrition education media. The basic concept behind this integration is to leverage the widely used instant messaging platform, WhatsApp, to provide easier and faster access to nutrition information.

The "WhatsApp Auto Reply" application is used as the foundation for developing the WhatsApp chatbot. This application enables the chatbot to respond to incoming messages quickly and efficiently. When users send a message to the chatbot, the algorithms within the application will recognize the message and provide an appropriate response based on the available options.

In its usage, the WhatsApp chatbot has a main menu that displays various options or submenus that can be chosen by the users. These submenus make it easier for users to interact with the chatbot according to their needs. For example, users can select submenus related to nutritional information for toddlers, a specific menu for pregnant women, or even a submenu that provides healthy food recipes. This provides users with flexibility in choosing the type of information they are looking for. With this integration, the WhatsApp chatbot enables users to obtain relevant nutritional information, tips, or guidelines in a more interactive and easily accessible manner. By optimizing the potential of WhatsApp as a highly popular instant messaging platform, this chatbot can provide significant benefits to the mothers in Lengkong Village in enhancing their knowledge about nutrition and the health of their toddlers.

Diagram 1
Flowchart Whatsapp

Prototype development

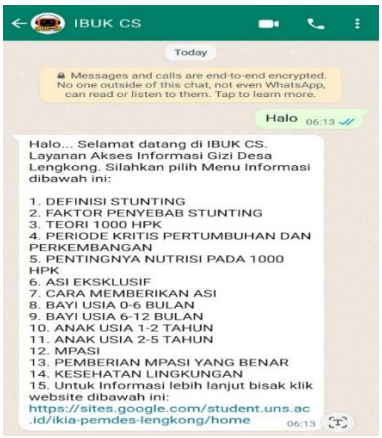
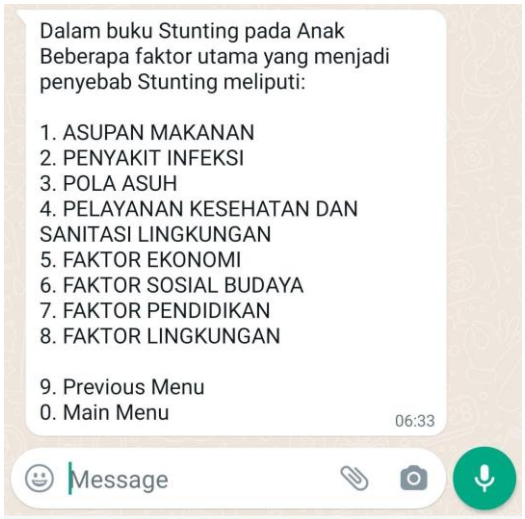
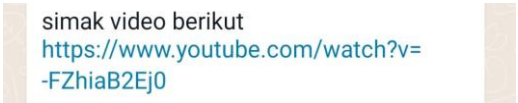
In the third stage, the researcher began the development of the WhatsApp chatbot prototype. This prototype encompasses the conversation flow, educational content, and interactive features that enable users to communicate with the chatbot to obtain the necessary nutritional information. The educational media that the researcher is developing is a Chatbot integrated into WhatsApp. This Chatbot is created using WhatsApp Auto Reply and distributed in the form of a contact with content related to nutrition, videos, and links to websites. The primary goal of using this educational media is to capture the users' attention, particularly mothers of toddlers, with the hope of enhancing their knowledge of nutrition.

The resulting product has been tailored to the nutrition-related materials, making it usable in both Posyandu (integrated health service posts) and at home, as well as in various locations and at any time. Through interactions with this Chatbot, mothers of toddlers can train their cognitive abilities in a simple and efficient manner. The WhatsApp-integrated Chatbot is designed in such a way that the content is delivered quickly and accurately. Furthermore, the goal is to create a practical learning experience, avoid boredom, and assist mothers of toddlers in meeting potential unfulfilled needs compared to their previous experiences attending Posyandu.

With the presence of this Chatbot, mothers of toddlers have the flexibility to access nutrition education materials before, during, or even outside of the Posyandu events, making it an effective tool to enhance their knowledge about nutrition. WhatsApp Chatbot developed by the researcher will be named IBUK CS, which stands for "Ini Bot Untuk Kesehatan Cegah Stunting" (This Bot for Preventing Stunting Health). IBUK CS is an innovative solution designed specifically to provide information and guidance related to preventing stunting in children. IBUK CS functions as a virtual partner ready to provide accurate information, nutritional guidance, and answer questions about child health, all with the goal of ensuring that children grow and develop well, avoid the risk of stunting, and have a healthy and bright future.

Table 2
Logo Display Chatbot IBUK CS

Table 3
Media display Chatbot IBUK CS

No	Picture	Explanation
	Main Menu	
	Material	
	Link Video	
	Link Website	

Evaluation and Improvement

Finally, the researcher carried out the evaluation and improvement stage. The researcher tested the WhatsApp Chatbot prototype with several respondents and collected input and feedback from them. The results of these trials helped the researcher

identify areas for improvement and enhancement in the WhatsApp Chatbot. With this data, the researcher can make improvements and refinements to ensure that this WhatsApp Chatbot is effective in providing useful nutrition information education for mothers of toddlers.The results of this research provide valuable insights into the use of WhatsApp Chatbot as a media for nutrition information education for mothers of toddlers. By using the prototype model approach, we were able to develop a WhatsApp Chatbot that is more aligned with user needs and preferences, making it an effective tool in enhancing the nutrition knowledge of mothers of toddlers.

DISCUSSION

Access to Nutrition Information in Lengkong Village

The research results show that nutrition knowledge is often conveyed through various activities, such as meetings at the Integrated Health Post (Posyandu) for toddlers, the elderly, and also in classes for pregnant women. This information is generally shared through oral discussions and is available in the form of KIA books as reading references. The community's response to this nutrition information is generally positive, although it is often not followed by concrete actions in applying the knowledge.

Based on research conducted by Rahmawati in 2019, the researcher suggests that parents should be more proactive in their efforts to enhance their understanding of stunting issues by accessing various media sources available. Disseminating information through various media platforms, such as the internet, television, or social media, can be an effective tool for providing knowledge about stunting to parents and caregivers. This way, parents can more easily access relevant information, recognize signs of stunting, and understand the steps that can be taken to prevent it. Active efforts to seek information from various media sources can provide stronger support in maintaining the optimal health and growth of children.[10] In the context of research on stunting, awareness and knowledge of nutrition have been identified as key factors that have a significant impact on the stunting rate. The awareness of parents and caregivers about the importance of proper nutrition for child growth, as well as their understanding of nutrition, is a critical element in stunting prevention. These findings are consistent with the results of research conducted by Simanjuntak in 2022, which highlights the urgency of improving maternal

[10] Anita Rahmawati, Thatit Nurmawati, and Liliani Permata Sari, 'Faktor Yang Berhubungan Dengan Pengetahuan Orang Tua Tentang Stunting Pada Balita', *Jurnal Ners Dan Kebidanan (Journal of Ners and Midwifery)*, 6.3 (2019), 389–95 <https://doi.org/10.26699/jnk.v6i3.ART.p389-395>.

knowledge through nutrition education programs. In order to prevent stunting, educational and outreach efforts aimed at providing accurate information and a better understanding of nutrition are essential steps to be implemented. With improved knowledge, parents and caregivers will be better able to plan and provide appropriate nutrition, ensuring that children receive sufficient nutrition for optimal growth and development.[11]

Based on the results of this research, it can be concluded that Posyandu (Integrated Health Post) is the primary source of nutritional knowledge for the mothers who were the subjects of the study. Information about nutrition is typically conveyed orally at Posyandu. Although guidebooks are available, most mothers are not actively seeking nutritional information from these books. This indicates the potential to develop chatbot technology as an innovative solution to support access to nutritional information. Given that chatbots can provide practical and personalized nutritional information, this technology has the potential to offer more efficient support in delivering nutritional knowledge to mothers of toddlers.

The Potential of WhatsApp Chatbot as a Nutritional Information Access

Based on the data collected from the questionnaires provided to mothers of toddlers, it can be concluded that the utilization of a chatbot as an innovation to access nutritional information for preventing stunting holds positive potential. This conclusion aligns with previous research findings by Lu Xu in 2021, which indicated that the integration of chatbots in clinical practice has the potential to work collaboratively with healthcare professionals with the goal of reducing costs, enhancing work process efficiency, and improving outcomes for patients. Most of the mothers who were respondents in this study demonstrated an understanding of chatbots or automated messaging, indicating that this concept is well-received and comprehended by them.[12]

Accurate and easily accessible nutritional information plays a crucial role in efforts to prevent stunting in toddlers. Delivering nutritional information to parents and the community, in general, has the potential to raise awareness about the importance of

[11] M. Simanjuntak and others, 'Pengaruh Inovasi Edukasi Gizi Masyarakat Berbasis Social Media Marketing Terhadap Pengetahuan, Sikap, Dan Perilaku Dalam Upaya Pencegahan Stunting', *Jurnal Ilmu Keluarga Dan Konsumen*, 15.2 (2022), 164–77 <https://doi.org/10.24156/jikk.2022.15.2.164>.

[12] Lu Xu and others, 'Chatbot for Health Care and Oncology Applications Using Artificial Intelligence and Machine Learning: Systematic Review', *JMIR Cancer*, 7.4 (2021), e27850 <https://doi.org/10.2196/27850>.

adopting a healthy and balanced diet for a child's growth and development. This is because the eating habits practiced by parents are significantly related to the incidence of stunting.[13] Accurate nutritional information also provides guidance on the amount and frequency of food consumption needed to meet a child's nutritional requirements.[14] With a good understanding of nutrition, parents are able to create a balanced and adequate diet for their children, preventing nutritional deficiencies that can lead to stunting. Mothers' knowledge about nutrition is one of the factors related to stunting in toddlers.[15] Easy access to nutrition information helps parents choose quality and nutritious foods. Previous studies have also suggested that delayed introduction of complementary foods is associated with stunting and severe stunting in Indian infants aged 6-8 months. Other modifiable factors associated with stunting and severe stunting include limited maternal education and low household wealth. [16]

WhatsApp, as the dominant application among the mothers who participated in the study, demonstrates significant popularity. This aligns with one of the main benefits of WhatsApp highlighted by Valtolina (2019), which is the ease of using chatbots as instant messaging applications.[17] This creates a very good opportunity to integrate chatbots as a means of accessing nutrition information, considering that WhatsApp has a very wide user base. Therefore, the use of chatbots in this context can be an efficient approach to disseminating nutrition knowledge to a large number of mothers of toddlers, supporting stunting prevention efforts in an easily accessible and relevant manner.

The Development of WhatsApp Chatbot with Human Computer Interaction (HCI) Theory

In chatbot development, a crucial step is to create a design that aligns with the analysis of user needs. Requirement analysis is a process that involves a deep understanding of what the chatbot users desire and what they require in their

[13] Yanti, Betriana, and Kartika.
[14] Ulul Azmy and Luki Mundiastuti, 'Konsumsi Zat Gizi Pada Balita Stunting Dan Non-Stunting Di Kabupaten Bangkalan', *Amerta Nutrition*, 2.3 (2018), 292 <https://doi.org/10.20473/amnt.v2i3.2018.292-298>.
[15] Rizqita Catur Wulandari and Lailatul Muniroh, 'Hubungan Tingkat Kecukupan Gizi, Tingkat Pengetahuan Ibu, Dan Tinggi Badan Orangtua Dengan Stunting Di Wilayah Kerja Puskesmas Tambak Wedi Surabaya', *Amerta Nutrition*, 4.2 (2020), 95 <https://doi.org/10.20473/amnt.v4i2.2020.95-102>.
[16] Rachmah and others.
[17] Stefano Valtolina, Barbara Rita Barricelli, and Serena Di Gaetano, 'Communicability of Traditional Interfaces VS Chatbots in Healthcare and Smart Home Domains', *Behaviour & Information Technology*, 39.1 (2020), 108–32 <https://doi.org/10.1080/0144929X.2019.1637025>.

interactions with the technology. By understanding user needs carefully, we can design an interface that is more relevant and beneficial. A design that aligns with requirement analysis ensures that the chatbot can provide effective solutions, meet user expectations, and deliver a positive experience. This also aids in optimizing the interaction between humans and technology, making the chatbot a useful and efficient tool in providing information or services needed by users. Therefore, design that takes user requirement analysis into consideration is a crucial step in achieving success in chatbot development. The researcher utilized the Human-Computer Interaction (HCI) theory, which plays a key role in the development of the WhatsApp chatbot focused on nutritional information. In the context of developing a nutrition chatbot, the HCI theory is employed to design a user-friendly and efficient interface for users, who are parents seeking information about their children's nutrition. Factors such as message clarity, ease of navigation, responsiveness to user requests, and user-friendly design are all taken into account. Additionally, the HCI theory considers the psychological aspects of users, such as how parents can interact with the chatbot naturally and comfortably. The use of visual elements, clear messages, and overall chatbot layout planning can help in presenting nutritional information more effectively. Therefore, applying HCI principles in the development of a WhatsApp nutrition chatbot ensures that the chatbot becomes an efficient and effective tool in delivering nutritional knowledge and supporting the prevention of child stunting.

In the continually evolving digital technology era, chatbots have become an intriguing topic in the world of technology. Chatbots are computer programs designed to simulate human conversations. The Human-Computer Interaction (HCI) theory is an approach used to study how humans interact with computer technology. In the context of chatbots, HCI theory is used to understand how humans interact with chatbots and how interaction designs can be tailored to meet the needs and abilities of users. Its main goal is to enhance user experience and system effectiveness.[18] In the development of a chatbot, HCI principles are applied to create an interface that is easy to understand, responsive, and user-friendly. The interaction design of the chatbot should take into account user capabilities, such as digital literacy, communication styles, and individual user

[18] Ann Blandford and Simon Attfield, *Interacting with Computers: HCI Models, Theories, and Frameworks. Synthesis Lectures on Human-Centered Informatics*, 1st edn (San Francisco: Morgan Kaufmann Publisher, 2007), I.

preferences. Additionally, psychological aspects, such as users' needs to emotionally connect with the chatbot, should also be considered.

Researcher employed the characteristics of the 1000 HPK theory in creating the WhatsApp chatbot.

The "1,000 Days Hypothesis" theory, proposed by Reynaldo Martorell, is a concept that suggests that the first 1,000 days of a child's life, from pregnancy to the first two years after birth, play a crucial role in preventing stunting.[19]

The 1000 HPK theory is a concept related to preventing stunting and efforts to achieve optimal growth in children. The abbreviation "1000 HPK" refers to the First 1000 Days of Life (HPK), which starts from conception until the age of two. This concept emphasizes the importance of proper care and nutrition during this critical period to ensure the healthy development of a child.

In the context of preventing stunting and ensuring optimal child growth, the 1000 HPK theory encompasses several key aspects:

1. Maternal Nutrition

   During pregnancy, mothers need to receive adequate nutrition to support fetal growth. Sufficient nutritional intake during pregnancy is crucial, including vitamins, minerals, protein, and iron.

2. Exclusive Breastfeeding

   Providing Exclusive Breastfeeding (EBF) for the first six months of a baby's life is a crucial step in preventing stunting. Breast milk contains all the necessary nutrients for the infant and helps strengthen the immune system.

3. Complementary Feeding

   After six months of age, appropriate complementary feeding is vital. Complementary foods should be nutrient-rich and prepared correctly.

4. Healthcare

   Accessing regular healthcare, including immunizations, for children during the 1000 HPK period is essential for preventing diseases and health issues that can hinder growth.

5. Hygiene and Sanitation

[19] John Hoddinott and others, 'The Economic Rationale for Investing in Stunting Reduction', *Maternal & Child Nutrition*, 9 (2013), 69–82 <https://doi.org/10.1111/mcn.12080>.

Maintaining cleanliness and environmental sanitation where children live is essential to prevent diseases and infections that can disrupt growth.

6. Nutrition Education and Balanced Diet
   Providing nutrition education to parents about a balanced diet and the importance of food variety in a child's diet is crucial.
7. Monitoring Child Growth.
   Monitoring a child's growth regularly to ensure healthy growth and promptly addressing growth issues if they arise.

The 1000 Days Hypothesis is a concept that focuses on a critical period in a child's growth and development, which spans the first 1000 days of life, from conception to the child's second birthday.[20] Within this theory framework, there are several critical periods that significantly impact a child's development:

1. Conception to Early Pregnancy (0-270 days)
   This period is crucial because the early development of vital organs and systems in the fetus occurs during this phase. A mother's nutrition during conception and the first trimester greatly influences fetal development.
2. Pregnancy (270-365 days)
   In the second year of the fetus's life, the growth of organs and body systems initiated in the preceding period continues. Nutrition, vitamin intake, and minerals during pregnancy remain key factors.
3. Birth to the First 6 Months (365-545 days)
   During the first six months of life, exclusive breastfeeding is highly important. Breast milk provides all the necessary nutrients for the baby and helps strengthen the immune syste.
4. 6 Months to 2 Years (545-1000 days)
   After six months, children need to start introducing appropriate complementary feeding. This period is when children begin to receive additional nutrition from solid foods. Complementary foods should be nutrient-rich and prepared correctly.
5. Healthcare and Immunization (365-1000 days)

[20] Nurul Hidayah and Marwan Marwan, 'Upaya Pemberdayaan Masyarakat Dalam Menciptakan Generasi Milenial Sadar Gizi Yang Bebas Stunting Melalui Kegiatan 1000 HPK', *Journal of Community Engagement in Health*, 3.1 (2020), 86–93 <https://doi.org/10.30994/jceh.v3i1.41>.

Throughout this period, proper healthcare and immunization must be maintained to protect children from diseases and health issues that can hinder their growth.

6. Nutrition Education and a Balanced Diet (365-1000 days)
   Providing nutrition education to parents and caregivers about a balanced diet and the importance of food variety in a child's diet is also essential.

Adequate nutrition during the first 1000 days of a child's life (from conception to the child's second birthday) is crucial to support optimal physical growth and brain development. This is why this period is often referred to as the "golden period" in an individual's life, as the developments that occur during this time have long-term impacts on a child's health and development.[21]

Here are some reasons why adequate nutrition is crucial during this period:

1. Optimal Physical Growth:
   During this period, a child's body grows rapidly and builds fundamental physical structures. Adequate nutrition is the fuel for the growth of bones, muscles, and vital organ.
2. Brain Development
   Nutrition plays a key role in a child's brain development. Nutrients like omega-3 fatty acids, iron, folate, and B vitamins are essential for optimal cognitive and brain function. Nutritional deficiencies can hinder cognitive development.
3. Immune System Support
   Adequate nutrition supports a child's immune system. Children who receive proper nutrition are more resistant to diseases and infections, which can impact their growth and development.
4. Energy and Physical Activity
   Children who receive adequate nutrition have enough energy to play and be active. Physical activity is crucial for muscle and bone development and a child's overall health.
5. Stunting Prevention

[21] Agus Samsudrajat S and Sutopo Patria Jati, 'Kebijakan Penyelamatan 1000 Hari Pertama Kehidupan (1000 HPK) Dan Penurunan Stunting Di Kota Semarang', *Jurnal Manajemen Kesehatan Indonesia*, 6.1 (2018), 1–7 <https://doi.org/10.14710/jmki.6.1.2018.1-7>.

Stunting, a condition where a child has shorter stature than they should, is often caused by malnutrition during the first 1000 days. Adequate nutrition can prevent stunting and help children achieve optimal height.

6. Prevention of Chronic Health Conditions
   Poor nutrition during this period can increase the risk of chronic health conditions later in life, such as diabetes, obesity, and cardiovascular diseases.
7. Improved Quality of Life in the Future
   Good nutrition during the first 1000 days provides a strong foundation for a child's growth and development, which will positively impact their quality of life as adults.

All the materials available on the WhatsApp chatbot refer to the principles of the 1000 HPK (First 1000 Days) Theory with the aim of providing information and guidance suitable for caring for children during this critical period. The 1000 HPK Theory emphasizes the importance of optimal care and nutrition during the first 1000 days of a child's life, from conception to the first two years. With reference to this theory, the chatbot provides information on breastfeeding, complementary feeding, brain development, early stimulation, and necessary healthcare. Additionally, the chatbot offers highly relevant age-based guidance to help parents plan a balanced diet and provides important reminders, such as immunization schedules. In this way, the chatbot becomes a reliable and relevant source of information to assist parents in caring for their children during the first 1000 days, ensuring the optimal health and development of children and preventing stunting.

CONCLUSION

The results of the research show that knowledge about nutrition is often communicated through various activities, such as meetings at Posyandu for toddlers, parents, and pregnant women. This information is usually conveyed through oral discussions, and the KIA book is available as a reference for reading. Although the community's response to this nutrition information is generally positive, it is often not followed by concrete actions to implement it.As the most popular application among mothers of toddlers, this is in line with one of the main benefits of WhatsApp, which is the ease of using a chatbot as an instant messaging application. Therefore, the wide user base of WhatsApp creates a great opportunity to integrate a chatbot as a tool for accessing

nutrition information. In this regard, using a chatbot can be an effective way to teach nutrition to many mothers of toddlers.

The researcher used the Human-Computer Interaction (HCI) Theory to create a WhatsApp chatbot that focuses on nutrition. The researcher created a user-friendly interface for parents seeking information about the nutrition of their children. Factors such as message clarity, ease of navigation, responsiveness to user requests, and user-friendly design were highly considered.

The 1000 HPK Theory, or the First 1000 Days of Life, emphasizes the importance of optimal nutrition and care during the first 1000 days of a child's life, from conception to the first two years, and all the content available on the WhatsApp chatbot focuses on these principles to provide appropriate guidance on how to care for children during this critical period. The chatbot provides information on breastfeeding, complementary feeding, early stimulation, and necessary healthcare by referring to this theory.

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