7th International Conference on Learning Innovation and Quality Education (ICLIQE 2023)

SHEs: Conference Series 6 (2) (2023) 298-306

Learning Media Chatbot: Technology Innovation for Stunting Prevention

Umu Sholihah, Sarwanto, Fatma Sukmawati

Universitas Sebelas Maret
umu_s812302049@student.uns.ac.id

Article History
accepted 31/7/2023 approved 31/8/2023 published 30/9/2023

Abstract
Stunting remains a global health issue at present. One important factor in preventing stunting is adequate nutrition from early stages. However, access to accurate and timely nutritional information continues to be a challenge, especially in remote and rural areas. In response, this qualitative study aimed to analyze the use of Chatbots as a facility for accessing nutritional information in an effort to prevent stunting. The data were collected through questionnaires and interviews. It involves 40 mothers with toddlers actively participating in the local integrated health posts (posyandu) as research subjects, selected specifically using purposive sampling. The data obtained from this research will be analyzed using the Miles and Huberman model. The research findings indicate that the current methods of delivering nutritional information, such as lectures and guidebooks, have limited impact in preventing stunting. Therefore, a chatbot emerges as a suitable medium for providing accessible nutritional information. This study contributes to addressing the global health issue of stunting and offers a potential technological solution to enhance access to nutritional information.
Keywords: *Learning Media, Chatbot, Stunting*

Social, Humanities, and Education Studies (SHEs): Conference Series p-ISSN 2620-9284
https://jurnal.uns.ac.id/shes e-ISSN 2620-9292

INTRODUCTION

In the digital era, the education sector needs to adapt, especially in terms of instructional media. There are several challenges when teachers deliver lessons to students, where students sometimes feel bored and appear unengaged in the subject matter [1]. Similar challenges exist in rural areas when midwives provide information to mothers about health and nutrition. At times, mothers in rural areas may feel bored or less interested in engaging with the information shared by midwives. Therefore, creative and innovative approaches are needed in information delivery to actively involve mothers and emphasize the importance of knowledge about health and nutrition.

Chatbot has become an intriguing topic in the field of technology. Chatbot is a computer program that simulates human conversation [2]. Human-Computer Interaction (HCI) theory is an approach used to study the interaction between humans and computer technology. In the context of chatbot, HCI theory is applied to understand how humans interact with chatbots and how the design of these interactions can be tailored to user needs and capabilities. The goal is to enhance user experience and system effectiveness [3]. In the development of chatbots, HCI principles are employed to create interfaces that are intuitive, responsive, and user-friendly. The design of chatbot interactions should consider user capabilities, such as digital literacy level, communication habits, and user preferences. Additionally, psychological aspects also need to be considered, such as the user's need to feel emotionally connected to the chatbot.

The previous conducted by Alexander Wang et al. (2023) indicates that Chatbot is well-received by patients and has proven effective in automating various tasks related to cancer screening, prevention, risk assessment, therapy, symptom management, and survivorship monitoring. Chatbots offer significant potential for future applications as they promote patient-centered communication, enhance accessibility to treatment, reduce operational costs, and save time for nurses and doctors. The implementation of chatbots in the healthcare field has drawn attention as an innovative approach. The adoption of chatbots in healthcare has the potential to improve the efficiency of the healthcare system and provide more personalized and individualized services. Previous research has shown that chatbots are well-received by patients and effective in automating cancer screening, prevention, risk assessment, therapy, symptom management, and patient recovery [4]. Moreover, in the context of the COVID-19 pandemic, high-risk individuals experiencing severe symptoms may have fear of contamination. Through email or personal communication, service providers can engage these individuals and encourage them to interact with virtual service agents to maintain social distancing during service delivery and alleviate their fear of contamination. Other studies indicate that the availability of artificial intelligence [5] (AI)-supported interventions is a crucial effort to reduce the prolonged burden on mental health practitioners and address the growing workforce shortages in mental health [6]. Additionally, a study showed that medical students in Germany are willing to engage more intensively with AI in the field of medicine. In this study, they could develop a fundamental understanding of how AI and chatbots will impact their future daily work [7].

The current global challenges, which are inevitable due to the ongoing COVID-19 pandemic, increasingly evident climate change, rising economic impacts, and prevailing conflicts, have led to supply shortages and increased food prices. The impact of this food crisis has exacerbated the problem of malnutrition in various forms. Malnutrition and the risk of stunting due to widespread hunger are increasing [8]. Prasanti (2022) states in her book "Stunting in Children" that in 2017, around 151 million (22%) children under the age of five experienced stunting. One of the six targets in the Global Nutrition Targets for 2025 is to reduce the prevalence of stunting

in children under the age of five. Although the government has implemented various structured programs to address nutritional issues in toddlers, there are still many cases of stunting in this age group [9]. Lack of nutrition during the critical period of the first 1,000 days of life, according to the Ministry of Health of the Republic of Indonesia (2018), is the main cause of stunting in children [10]. The "1,000 Days Hypothesis" theory proposed by Reynaldo Martorell is a concept that emphasizes the importance of the first 1,000 days of a child's life, starting from pregnancy until the first two years after birth, in preventing stunting [11]. This approach emphasizes the importance of proper nutrition to support the child's growth and development. During this period, children undergo rapid growth and development, including the development of vital organs and the nervous system. If adequate nutrition is not provided, children are at risk of experiencing growth delays that can have long-term effects on their health and development. Multifaceted factors require the most stringent interventions during the first 1,000 days of life [12].

Previous research conducted by Ulul Azmy (2018) states that research findings show that most stunted toddlers have low nutrient consumption (such as energy, fat, protein, carbohydrates, zinc, and iron). There is a relationship between energy, protein, fat, carbohydrate, and zinc intake with the nutritional status of toddlers (based on the height-for-age index), thus it is important to ensure adequate nutrient intake during the toddler period.[13] Consistent with previous research conducted by Rizqita Catur Wulandari (2020), research results indicate that the adequacy level of energy, protein, calcium, as well as maternal knowledge, is associated with the risk of stunting in toddlers in the working area of Tambak Wedi Health Center.[14] Qonita Rachmah (2020) based on her article, nutrition education has a significant influence in improving maternal knowledge about preventing stunting during the golden period of development. The availability of regular nutrition education programs by nutrition officers at health centers and by integrated health post cadres is an important step in preventing stunting.[15]

Accurate and easily accessible nutrition information plays a crucial role in preventing stunting in children. Providing parents and the general public with nutrition information can increase awareness of the importance of a healthy and balanced diet for the growth and development of children, as parental feeding practices have a significant relationship with the occurrence of stunting [16]. Accurate nutrition information also provides guidance on the quantity and frequency of food consumption needed to meet children's nutritional needs [17]. 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[18]. Easily accessible nutrition information can assist parents in selecting quality and nutritious foods. Previous research has stated that delayed introduction of complementary feeding is associated with stunting and severe stunting in 6-8-month-old infants in India. Modifiable factors associated with stunting and severe stunting include maternal education and low household wealth [19].

Clear and trustworthy nutrition information can help change perceptions and attitudes towards nutrition, thus promoting better feeding practices and the prevention of stunting in children. To prevent poor nutrition, stunting, and wastage in children, it is important to provide effective and cost-efficient multitier care during the pre-conception, prenatal, and postnatal periods [20].

Considering the urgency and complexity of stunting as a global health problem, ongoing research is needed to enhance our understanding of stunting and develop effective solutions to prevent and address this issue. This research can provide a basis for better public policies, more effective interventions, and measures that can reduce the burden of stunting and provide a better future for future generations.

Based on the above description, the researchers intend to investigate the use of chatbot media as a means of accessing nutrition information to enhance the knowledge of mothers of toddlers about nutrition. This research aims to analyze the potential of chatbots as a technological innovation that can provide support in stunting prevention efforts. By utilizing chatbots, users can easily ask nutrition-related questions and receive accurate answers and appropriate recommendations. Chatbots can also provide personalized nutrition information. Through the availability of chatbots as interactive and accessible sources of nutrition information, it is hoped that the public can gain broader and practical knowledge about nutrition and increase their awareness of the importance of preventing stunting.

METHODS

This research utilizes a qualitative descriptive approach to gain a deep understanding of the phenomenon under study [21] , which is the potential use of chatbots as a nutrition information resource. The research involves 40 mothers of toddlers as research subjects. The selection of subjects is done specifically using purposive sampling method. The research subjects are selected based on certain criteria, namely mothers of toddlers who actively participate in posyandu (integrated health post) to align with the research objectives. Data collection techniques include questionnaires and interviews. Data analysis follows the Miles and Huberman model, which involves a series of steps such as data collection, data reduction, data display, and conclusion drawing. This data analysis will help identify patterns, themes, and relationships emerging from the collected data. The research was conducted in May 2023 at the posyandu in Lengkong Village, Balen Sub-district, Bojonegoro Regency.

RESULTS AND DISCUSSIONS

This research was conducted in two different Posyandu (Integrated Health Service Posts) and involved 40 participants, who were mothers of toddlers actively participating in the activities at the Posyandu. The objective of this study was to gain an in-depth understanding of access to nutrition information for stunting prevention. The research adopted a qualitative approach with a descriptive method. Data collection methods included questionnaire distribution and interviews. The participants were selected using purposive sampling, specifically targeting mothers of toddlers actively participating in Posyandu activities.

Based on interviews with the Midwife, it was explained that in the village of Lengkong, nutrition information is usually conveyed through various activities such as Posyandu for children, Posyandu for the elderly, and classes for expectant mothers. The information is primarily communicated orally, and mothers are also provided with the KIA (Mother and Child Health Handbook) for reading. However, the Midwife mentioned that alternative media have not been used to deliver such information. Regarding the effectiveness of information delivery through these media, the Midwife stated that although mothers responded positively when asked, the practical application of the information in their daily lives was not evident. When asked if anyone read the KIA book, most mothers simply smiled, indicating that the majority of them did not read the book. Yet, the KIA book contains valuable information.

According to the Midwife, the community's reaction to nutritional information is generally positive, but it is not accompanied by concrete steps in implementing the information in their daily life. Awareness and knowledge about nutrition are considered as the main factors influencing this. The Midwife also mentioned that the economic factor of the family may play a role, but there are cases where families are economically capable yet their children still have insufficient nutritional intake. This is attributed to the lack of knowledge and awareness about nutrition within the family. Interestingly, the Midwife emphasized that the majority of the mothers who attend the

posyandu have completed high school education, indicating that education is not the primary cause, but rather the lack of knowledge and awareness about nutrition.

In addition to conducting interviews, this research also employed a questionnaire survey method to gather data from the participants. The questionnaire distributed to the participants consisted of a series of questions related to nutritional information.

Table 1. The Results of the questionnaire distributed to 40 participants regarding access to nutritional information

data	Number of respondents	Description
obtain nutrition informatio	40	Posyandu
Information delivery	40	Orally
Obtaining a guidebook from the integrated health post (posyandu)	40	Yes
Previously seeking information from a guidebook.	33	No
	6	rarely
	1	Yes

From the questionnaire results obtained from the 40 participants, all of them stated that they obtain nutritional information from the posyandu. This indicates that the posyandu is the main source of nutritional information for the mothers. In this study, all participants (40 individuals) reported that nutritional information is conveyed orally. This indicates that verbal communication is the primary method used to deliver nutritional information to the mothers. From all the participants who completed the questionnaire (40 individuals), all mothers stated that they are provided with a guidebook from the posyandu. This indicates that the posyandu provides guidebooks to the mothers as a source of nutritional information. From the questionnaire results, 33 participants stated that they have never sought nutritional information through the guidebook provided by the posyandu. Meanwhile, 6 participants stated that they rarely seek it, and only 1 participant stated that they have sought it. This suggests that the guidebook provided by the posyandu is not the primary source for obtaining nutritional information for the majority of the mothers.

It is possible to make conclusions based on these observations, that the posyandu is the main source of nutritional information for the participating mothers. Nutritional information is primarily conveyed orally during posyandu sessions. Although the mothers are provided with guidebooks, the majority of respondents do not actively seek nutritional information through the guidebook. These findings highlight the potential for developing chatbots as a technological innovation that can support access to nutritional information, considering that chatbots can provide practical and personalized nutritional information.

Table 2. Distribution of questionnaires to 40 participants regarding chatbots

data	Number of respondents	Description
Knowledge about chatbots	36	Yes
	4	No
In applications	32	whatsapp
	4	telegram
	4	No
Perspectives on	24	quick response

chatbots		
	8	accessible anytim
	4	easy access
	4	No
Having WhatsApp application	40	Yes

The data indicates that the majority of mothers have an understanding of the concept of chatbots or automated messaging. This suggests a potential for good acceptance and understanding of the use of chatbots in the context of stunting prevention. The findings indicate that WhatsApp is the most popular application among the respondent mothers. The widespread use of WhatsApp presents a good opportunity to implement chatbots as a means of accessing nutritional information for stunting prevention. However, it is still worth considering the use of other applications such as Telegram to reach a wider range of potential users. The data also shows that WhatsApp is widely used by the respondent mothers. The availability of this application enables the effective implementation of chatbots to provide nutritional information and support stunting prevention efforts. The results of the data reveal a positive perception of chatbots as a communication tool. Speed of response and flexible accessibility are considered important aspects by the mothers.

The conclusion drawn from the analysis of this data indicates the potential use of chatbots as a means of accessing nutritional information in stunting prevention efforts. The majority of mothers have a basic understanding of chatbots and have the WhatsApp application, which can be used as a medium of interaction. The advantages deemed important by the mothers, such as quick response and anytime accessibility, demonstrate the potential of chatbots in providing fast and easily accessible information support. However, further efforts are needed to enhance mothers' understanding and awareness of the potential of chatbots in stunting prevention and address the lack of understanding among some respondents regarding the applications used for chatbots.

Access to Nutritional Information for Stunting Prevention

The research findings indicate that information about nutrition is usually conveyed through various activities such as toddler Integrated Health Posts (Posyandu Balita), elderly Integrated Health Posts (Posyandu Lansia), and prenatal classes. This information is primarily presented orally, with the Maternal and Child Health Handbook serving as supplementary reading material. The community's reaction to nutritional information is generally good, but it is not always accompanied by concrete efforts to put the information into action. According to Rahmawati (2019), parents can improve their understanding of stunting by actively obtaining information from many available media sources[22]. Nutrition awareness and knowledge are regarded as main elements influencing stunting, according to Simanjuntak's (2022) study, which showed that boosting mothers' knowledge through nutrition-related education plays a critical role in stunting prevention efforts[23].

Insufficient economic conditions within families can result in limited purchasing power for nutrient-rich foods, thereby increasing the risk of macro and micronutrient deficiencies, which in turn increases the likelihood of stunting in children [24]. Although the economic factor in the family may play a role, there are cases where families are economically capable but still fail to provide adequate nutrition to their children. The majority of mothers who attend Integrated Health Posts have a high school education level, indicating that education is not the primary cause but rather the lack of knowledge and awareness about nutrition, as maternal knowledge plays a crucial role in child development [25]

Based on these findings, it can be concluded that Integrated Health Posts serve as the primary source of nutritional information for the participating mothers. The delivery of

nutritional information primarily occurs through oral methods at the Integrated Health Posts. Despite the provision of guidebooks, most mothers are not actively seeking nutritional information through those books. This highlights the potential of developing chatbots as a technological innovation that can support access to nutritional information, considering that chatbots can provide practical and personalized nutrition-related information.

Chatbot as Innovative Access to Nutrition Information

Based on the data obtained from the research, it can be concluded that the use of chatbot as an innovative access to nutrition information in the context of stunting prevention has great potential. This aligns with previous studies by Lu Xu (2021), which found that integrating chatbots into clinical practices has the potential to collaborate with healthcare practitioners, reduce costs, improve workflow efficiency, and enhance patient outcomes [26]. The majority of the participating mothers in the study had an understanding of chatbots or automated messaging, indicating a positive acceptance and comprehension of the concept.

Moreover, WhatsApp emerged as the most popular application among the participating mothers. Considering one of the main advantages for users is the ease of using chatbots within an instant messaging application [27], this presents a promising opportunity to implement chatbots as a means of accessing nutrition information, given the widespread usage of WhatsApp. Previous research has shown that the utilization of chatbots has been rapidly growing, with an estimated increase of 37% in chatbot deployment between 2017 and 2023, according to the "Chatbots - Global Forecast 2023" market research report [27]. According to the statistics, the participating moms frequently use WhatsApp, which provides an efficient platform for using chatbots for conveying nutrition information and aiding stunting prevention efforts.

Regarding the perceived advantages of chatbots according to the mothers, quick responses and flexible accessibility were considered significant aspects. This indicates that chatbots can offer fast and easily accessible information, tailored to the needs and schedules of the mothers. Chatbots store data in a database to recognize keywords within sentences, enabling them to make decisions in searching for information and answering questions [28].

In clonclusion, the use of chatbots as an innovative means of accessing nutritional information has the potential to support stunting prevention efforts. In its implementation, it is important to consider the use of popular applications such as WhatsApp, as well as increasing the understanding and awareness of mothers regarding the potential of chatbots as a source of nutritional information. Chatbots have the potential to enhance the quality and efficiency of services and improve the user experience by providing easy access to the required information.

CONCLUSION

This research indicates that chatbots have significant potential as a means to access nutrition information. The research findings demonstrate that a majority of mothers caring for toddlers actively use the WhatsApp application and have an understanding of chatbots. The use of chatbots through WhatsApp provides convenience in delivering practical and personalized nutrition information, making it an effective tool for communicating nutrition information to mothers of toddlers. By leveraging chatbot technology, access to nutrition information can be easily reached and accessed by the community, contributing to efforts in preventing stunting in toddlers.

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