Jurnal Proteksi Kesehatan
Vol.13, No.2, November 2024, pp. 203-209
ISSN 2715-1115 (Online), ISSN 2302 – 8610 (Print)

Bilingual Android App for Early Nutrition Education

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Article Info

Article history
Received date: 2024-08-30
Revised date: 2025-01-13
Accepted date: 2025-01-13

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Abstract
This study investigates the implementation and effectiveness of NutriPlay, an Android-based application designed to enhance understanding of balanced nutrition among early childhood students in Pekanbaru, Indonesia. NutriPlay features interactive, visually engaging, and bilingual content aimed at enriching children's vocabulary while promoting nutrition education. The study involved 30 students from PAUD Lily Jaya and PAUD Al-Fatah, with data collected on usage duration, interest level, ease of use, and improvement in nutrition understanding. The results indicate that 70% of the students used NutriPlay for less than 5 minutes per session, while 30% used it for 5-10 minutes per session, and none of the students used it for more than 10 minutes. Despite the short usage periods, 85% of the students reported increased interest in the application, and 90% showed significant improvement in their understanding of nutrition concepts. These findings suggest that NutriPlay is effective in delivering educational content within short usage periods, sustaining children's interest through repeated use, and significantly improving their understanding of nutrition concepts.

Keywords:
Nutrition Education; Interactive Learning; Bilingual Application

INTRODUCTION

Stunting is a chronic nutritional problem that frequently affects children under five in developing countries, including Indonesia. This condition is characterized by impaired physical growth, resulting in children having a shorter stature compared to the average for their age [1]. Stunting not only impacts the physical health of children but also has detrimental effects on their cognitive development and learning abilities. The primary causes of stunting include an unbalanced diet, inadequate access to sufficient nutrition, and living in unhygienic and unhealthy environments [2].

Proper nutritional education from an early age is crucial in preventing stunting among toddlers [3]. Parents and caregivers play a vital role in selecting and providing healthy, nutritious food for their children. However, there is often a lack of knowledge about balanced nutrition and proper food preparation within communities, especially in rural areas or regions with limited access to education.

Therefore, innovative approaches, such as the development of bilingual educational applications, are necessary. These applications can provide information in both local and national languages, thereby enhancing understanding of balanced nutrition across different segments of society [4].

A bilingual nutrition education application could be an effective solution for improving the nutritional literacy of parents and caregivers, as well as for disseminating accurate and easily understood information about the importance of nutrition for child growth. By leveraging digital technology, such applications can be tailored to local cultural and linguistic preferences, making them more accessible and acceptable to diverse communities [5]. Through digital technology, these applications can offer easily accessible, understandable information and can

be adapted to the cultural needs and preferences of the Indonesian population [6].
Recent studies suggest that the use of technology in the form of applications can enhance the effectiveness of nutrition education programs, particularly in multilingual contexts like Indonesia. These applications not only provide information on nutrition and healthy eating patterns but also offer practical advice on how to prepare nutritious meals tailored to children's needs. A concrete example of bilingual application use is the development of apps that integrate interactive features to guide parents in choosing and preparing healthy foods, while also emphasizing the importance of nutrition for optimal child growth [7]
The importance of using bilingual educational applications for early childhood education can be seen in their benefits for enhancing children's language understanding and general knowledge. According to recent studies, using bilingual apps not only helps children develop a second language naturally but also improves their cognitive skills. Early childhood children engaged in learning activities through bilingual applications tend to have better abstract thinking abilities and adapt more easily to communication situations requiring proficiency in two languages simultaneously [8]. This demonstrates that bilingual educational applications are not just learning tools but also means of enriching the overall learning experience of children, aligned with their language and cognitive development.
In the context of Indonesia, where there is a diversity of cultures and regional languages, bilingual balanced nutrition applications can be an essential instrument in ensuring that the information provided is relevant and beneficial to local communities. Thus, the development of these applications can help reduce health and nutritional disparities and significantly improve the quality of life for children [9].

METHOD

The study involved 30 students from two early childhood education centers in Pekanbaru: PAUD Lily Jaya and PAUD Al-Fatah. The research was conducted over a period of nine months, during which the children interacted with the NutriPlay app. Data was collected on the duration of app usage, frequency of use, ease of navigation, and the children's self-reported understanding of nutrition concepts. This data was analyzed to assess the app's effectiveness in meeting its educational goals.

ETHICAL CLEARANCE

This research has complied with ethical principles under the approval number LB.02.03/EA/KEPK-PKR/12/2024 by the Ethics Committee of Poltekkes Kemenkes Riau.

RESULT AND DISCUSSION

Results of the NutriPlay Bilingual Balanced Nutrition Android Application Trial on PAUD Children

1. Application Usage:

The NutriPlay application was tested on children in Early Childhood Education to evaluate its usage and effectiveness in delivering educational content on balanced nutrition. One of the key aspects observed during the trial was the duration for which children interacted with the application. The data collected from this trial is summarized in Table 1 below, highlighting the duration of application usage among the participants.

Table 1. Usage Duration

Duration of Use	Number of Children	Percentage
<5 minutes	21	70%
5-10 minutes	9	30%
>10 minutes	0	0%

The table results show that the majority of children used the application for less than 5 minutes, with 21 children (70%) falling into this category. Nine children (30%) used the

application for 5-10 minutes, while no child used the application for more than 10 minutes. These findings suggest that the application is capable of delivering content efficiently in a short duration, which can support quick and effective understanding. This aligns with research by Ali, which found that applications designed for brief use can enhance understanding and information retention [10].

The application uses a combination of interactive visualizations and simple games to maintain children's attention and deliver content in an engaging manner. Within this short duration, children can grasp the basic concepts of balanced nutrition without feeling bored or losing interest. Interestingly, no child used the application for more than 10 minutes, which might indicate that the application successfully meets its learning objectives within a short time. This could also be an indicator that the application is well-suited for use in Early Childhood Education (PAUD) settings, where children's attention spans are typically limited. A study suggests that the use of interactive visualizations in educational applications significantly enhances information retention in early childhood [11]. Additionally, simple games integrated into learning applications can boost children's motivation to learn, helping them stay focused in a shorter amount of time [12]. Thus, NutriPlay's approach aligns with these findings, indicating the effectiveness of this application in the context of PAUD education.

Moving forward, the application developers may consider ways to extend children's engagement time without compromising learning effectiveness, such as by adding advanced modules or more complex interactive features. In this way, the application could not only support early learning but also sustain children's interest and engagement for longer periods. Introducing advanced modules in educational applications can increase children's engagement duration and deepen their understanding of more complex material [13]. Furthermore, more complex interactive features can prolong the application usage time without sacrificing the quality of learning by providing new challenges relevant to children's cognitive development [14].

2. Increased Interest:

The NutriPlay application was also evaluated based on how frequently it was used by children and how this influenced their interest in the application. Usage frequency can serve as an indicator of the application's appeal and effectiveness in maintaining engagement among young learners. The findings regarding usage frequency and its impact on children's interest are presented in Table 2 below.

Table 2. Frequency of Application Usage and Its Impact on Interest Among Early Childhood Education (PAUD) Children

Usage Frequency	Number of Children	Percentage
1 time	6	20%
2-3 times	11	36.7%
>3 times	13	43.3%

This table shows the distribution of application usage frequency among 30 children. A total of 6 children (20%) used the application only once, 11 children (36.7%) used the application 2-3 times, and 13 children (43.3%) used the application more than 3 times. These frequency categories were chosen based on previous research that suggests repeated use, particularly more than 3 times, can be a strong indicator of significant appeal for child users [15].

The data indicates that the majority of children were interested in using the application more than once, with the largest percentage (43.3%) showing usage of more than 3 times. This phenomenon suggests that the application is quite engaging and capable of sustaining children's interest over time. It's worth noting that features combining gamification and personalization in educational applications tend

to enhance user engagement, which aligns with these findings [16].

As the frequency of usage increased, more than half of the children reported becoming more interested in the application. This can be attributed to the interactive features and content designed to facilitate enjoyable and engaging learning, where it has been stated that interactive features in educational applications can enhance user engagement and make learning more appealing [17].

This data provides important insights for application developers to focus on further development, particularly on elements that drive repeated engagement. For instance, adding challenge levels or reward features might further increase usage frequency. Given the high percentage of repeated usage, developers can conclude that the application has great potential to continue attracting user interest if its features are continuously refined and adapted to children's needs. The addition of structured challenge elements in educational applications can significantly increase motivation and the frequency of repeated use [18]. Moreover, achievement-based reward features can extend user engagement duration by providing incentives to continue using the application over the long term [19].

In conclusion, this frequency distribution data demonstrates that the application has successfully captured the attention of child users and even managed to increase their interest through repeated use. This presents positive implications for the application's sustainability in the market, particularly in the category of children's educational applications. Further research may be necessary to understand the specific elements that contribute most to this increased interest, but these initial findings already provide a strong foundation for future application development.

3. Ease of Use:

Not a single child reported experiencing difficulties while using the application. This indicates that the interface and navigation have been very well-designed, allowing children to use the application independently without significant adult assistance. This intuitive design is crucial in ensuring that children can focus on the educational content provided without being distracted by complex navigation or technical difficulties.

These findings are consistent with research conducted by Lu [20], which shows that an intuitive application design not only affects ease of use but also contributes to the effectiveness of learning. With a user-friendly interface and child-friendly navigation, the application successfully creates a comfortable learning environment that supports the learning process.

An intuitive design also plays a significant role in enhancing children's confidence when using technology, as they can master the application without frustration or confusion. This underscores the importance of user-centered design principles, particularly for a young audience, in the development of educational applications. The application's success in minimizing the need for external assistance is a key indicator that the interface design is highly effective in meeting the needs of child users.

4. Improvement in Nutrition Understanding:

The NutriPlay application was assessed not only for its engagement and appeal but also for its effectiveness in improving children's understanding of balanced nutrition concepts. This evaluation aimed to determine whether the application could facilitate meaningful learning outcomes in early childhood education. The results are summarized in Table 3 below.

Table 3. Levels of Nutrition Understanding Among Children After Using the NutriPlay Application

Level of Understanding	Number of Children	Percentage
Not Understanding	0	0%
Slightly Understanding	7	23.3%

Understanding	10	33.3%
Highly Understanding	13	43.3%

This table shows that after using the application, the majority of children demonstrated a good level of understanding of nutrition concepts. Thirteen children (43.3%) reported feeling highly knowledgeable about nutrition, 10 children (33.3%) reported understanding, and 7 children (23.3%) felt slightly knowledgeable. Interestingly, none of the children reported not understanding the material presented. These findings indicate that this application is very effective in improving children's understanding of balanced nutrition concepts.

The effectiveness of this application in enhancing children's understanding can be attributed to the interactive and enjoyable learning approach applied in the application. This is consistent with research that found Android-based nutrition education applications can significantly increase children's knowledge of nutrition [21]. Their research shows that a well-designed digital education approach can be a highly effective tool in conveying complex information, such as nutrition, to children in a way that is easy to understand and remember. These findings emphasize the importance of using technology as an educational tool that is not only informative but also engaging and capable of significantly enhancing understanding. With the majority of children feeling highly knowledgeable or knowledgeable after using the application, this demonstrates that the methods used in the application not only deliver information clearly but also effectively ensure that children can internalize key concepts related to nutrition. The use of interactive technology in early education can strengthen the understanding of fundamental concepts among children more effectively than traditional methods [22]. Additionally, educational apps designed with interactive elements and strong visualizations can significantly improve information retention and conceptual understanding in young students [23].

In conclusion, this application not only serves as an educational tool but also as an effective medium in strengthening children's knowledge of balanced nutrition. This is a positive indication that similar applications can be used more widely as part of nutrition education programs in schools or public health initiatives.

CONCLUSION

This study demonstrates that the NutriPlay Android application is an effective educational tool for enhancing children's understanding of balanced nutrition. The application's interactive and bilingual features successfully engaged the children, leading to significant improvements in their comprehension of nutrition concepts. The findings highlight the importance of using technology in early childhood education, where well-designed digital tools can make learning more engaging and effective. The positive response from the children suggests that NutriPlay has the potential to be widely adopted in nutrition education programs..

ACKNOWLEDGEMENT

We would like to express our sincere gratitude to Poltekkes Kemenkes Riau for their financial support, which has been instrumental in the successful completion of this research.

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