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Usability Testing of Pegia eHealth and Their Effects on Changes in Children's Dietary Intake

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Abstract

In the current technological era, intervention based on e-Health is necessary to improved children dietary intake. This research aimed to document the usability testing of Pegia eHealth and their effect on changes in children's dietray intake. A system usability scale (SUS) was used to assess usability and recall consumption to assess dietary intake in children. It was conducted in 8 preschool institutions located in 4 sub-districts (North, South, West, and East Purwokerto) in Banyumas Regency, Indonesia. Twenty mothers and preschool teachers participated in the usability test and 54 mothers and 54 children participated in the dietary intake test. Mothers received intervention for 12 weeks through Pegia e-Health, and we analyzed changes in maternal feeding practices and children's dietary intake. The total SUS score was 80.5±7.25.The SUS results indicated that Pegia eHealth is acceptable to users. After intervention by Pegia eHealth, there was a significant increase in dietary intake, including 31.15 g of carbohydrates, 1.44 g of fiber, and 380.07 RE of vitamin A ($p < 0.05$) of children.

Keywords: eHealth, Usability testing, Mothers, Dietray intake

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1. Introduction

Currently, technology-based nutritional interventions are one alternative that should be considered. According to Barnett [1] the use of e-Health technology offers innovative opportunities to strengthen community-based growth monitoring and make it more effective in addressing malnutrition in children. Bensley [2] compared nutrition intervention through technology-based education with conventional methods. The results showed that intervention through technology was more easily accepted and improved children's nutritional intake compared to conventional interventions. e-Health can be used to help overcome health problems in mothers and children. Around 62% of toddlers and preschool children are experiencing feeding problems [3]. It found that the nutritional density of food in preschool children was low, with most of the intake coming from snack, insufficient energy and protein density can affect their nutritional status. The lower the energy and protein intake density, the poorer the nutritional status. Vegetable and fruit consumption in preschool children is also a concern [4]. A Total Dietary Survey in Indonesia found that only 48% aged 0-59 months consume leafy vegetables, while the percentage increases to 66.6% for children aged 5-12 years [5].

According to previous research, children have similar dietary behavior with their parents. Children growing up in families with lazy or selective eating habits tend to adopt the same behavior [6]. Mustikasari [7] showed a correlation between mothers' parenting style and picky eaters in preschool children. According to Scaglioni [8] the formation of children eating patterns is influenced by parents' habits. Furthermore, parents are responsible for providing food for their children. Purnamasari [9] stated that mothers' knowledge about balanced nutrition was low, and this affected the quality of food provision at home, as well as impact the children's nutritional status. To overcome this problem, nutritional interventions can be provided through e-Health. Therefore, This research aimed to document the usability testing of Pegia eHealth and their effect on changes in children's dietray intake.

2. Material and methods

Sample

The sample in the usability testing was 20 individuals, consisting of 10 preschool teachers and 10 mothers. Meanwhile, the best amount for usability testing ranges from 8-25 samples [10]. The sample for the dietary intake test was 54 mothers and 54 children aged 3-6 years.

Instruments

eHealth Pegia was developed on the Android platform using Kodular, an open-source mobile application development framework. The Android platform was selected because 90.84% of Indonesians used it on their mobile phones [11]. Participants were required to install the Pegia eHealth application. The menu options available on the application included Checking the Nutritional Status of Children, Balanced Nutrition Guidelines, Healthy Children Menus, Nutrition Requirements, and Nutrition Posters. The example of the menu nutrition requirements and poster shown in Figure 1 and 2. Usability testing used the System Usability Score (SUS) to obtain the subjective assessment of the participants towards the application. A structured questionnaire and recording sheet for recalling children's dietary food.

Collecting Data

The respondents were asked to install the Pegia eHealth distributed through WhatsApp. For usability test, they were required to run all the application functions, including sharing and downloading posters. Furthermore, respondents were asked to complete the SUS Usability questionnaire. For dietary intake test, data collection was conducted for 12 weeks. In the first week, informed consent forms were filled out, install Pegia eHealth and baseline dietray data were collected. In the next weeks, mothers should practice balanced nutrition and healthy menus in feeding their children according to the guidelines contained in Pegia e-Health. In the twelfth week, endline data of dietray intake children were collected.

Data Analysis

In the usabillity test, users were given a SUS usability questionnaire consisting of 10 questions, each with a score of 0-4. Furthermore, odd-numbered and even-numbered questions such as “1, 3, 5, 7, 9” and “2, 4, 6, 8, 10” were positive-toned and negative-toned, respectively. The users provided five assessment scales, namely strongly agree, agree, neutral, disagree, and strongly disagree, with a value of 5, 4, 3, 2, and 1, respectively. For questions with an odd number or positive tone, the weight score is obtained by subtracting one answer from the user's scale. Meanwhile, for questions with an even number or a negative tone, the score weight is obtained by subtracting the user’s scale answer from 5. After the total weight score was obtained, the weighted score was multiplied by 2.5, so that the SUS score ranges from to 0-100. The overall SUS score was calculated as the average of individual SUS scores. The overall SUS score is formulated as follows:

$$U = \frac{\sum(R \; x \; 2.5)}{n}$$

U = SUS overall score

R = Total weight of all answers for each user, n = Number of users, Based on the overall score from SUS, the acceptable range category is obtained as follows[12]:

≤ 50 : not acceptable
>50 s.d 70 : marginal
> 70 : acceptable

For dietray intake test, we analyzed children’s dietary intake include energy, carbohydrate, protein, fat, fiber, iron and vitamin A. The paired sample t test was used to analyze the differences before and after the intervention since most of the data distributions normal (used mean data) and the wilcoxon test was used to analyze the differences before and after the intervention since most of the data distributions were not normal (used median data). The significance level was set at $p < 0.05$.

Ethical Approval

This research obtained ethical approval from the Ethics Committee of the Faculty of Health, Jenderal Soedirman University, Indonesia, Number 698/EC/KEPK/IV/2022.

3. Results and Discussions

System Usability Score (SUS) Testing

As shown in Table 1, almost all usability’s participants at 89.5%, responded positively. Statements 3 and 8 had the highest positive response at 100%, while statement 10 had the highest negative response at 25%. The highest average SUS score was found in statement 3 on the ease of using the application (9.12 ± 0.48), while the lowest was found in statement 10 (6.37 ± 1.14) on the need to learn many things before using the application. Furthermore, the total SUS score was 80.5 ± 7.25, and according to Bangor[12] a score greater than 70 means users will accept the application. This outcome is consistent with the findings of Georgsson and Staggers[13] which researched an mHealth application for diabetes education, yielding an average score of 80.5. According to Granja[14] adoption is the ability of users to understand the benefits and willingness to use mHealth on an ongoing basis. According to Zhao[15] factors that influence the adoption of a mobile health application include usability, ease of use, and perceived vulnerability or severity. In this study, all participants (100%) stated that the Pegia eHealth was easy to use, and as many as 90% stated that they would use the Pegia eHealth again, which meant that they w These findings hold promise for future mHealth developments. According to Amagai[16] user retention is a challenge in the development and implementation of mobile health. These results are the same as those of a study conducted by Rahayu[11], who examined the application of Sikibro and found high retention of the application due to its ease of use. Participants also agreed that the features in the Pegia eHealth were well integrated (90%). This is possible because the Pegia eHealth was developed with features that are easy for the users to understand.ere willing to adopt it for use in ongoing nutrition education activities for children. However, 25% needed education before using the application concerning their adaptation to new technology. To address this challenge in implementing a mobile health application, experts should provide users with an explanation of the benefits and usage before it is utilized for health education [16].

Table 1. SUS Usability Testing (n=20)

Statement	Response			Score
	Positive	Neutral	Negative	
I will use the application more often	18 (90%)	2 (10%)	0	8,12±0,63
I think the application is too complicated	18 (90%)	0	2 (10%)	7,50±0,79
I can use the application easily	20 (100%)	0	0	9,12±0,48
I think it requires technical assistance to be able to use the application	18 (90%)	1 (5%)	1 (5%)	8,0±0,76
I find that the features in the application have been well integrated	18(90%)	2 (10%)	0	8,25±0,65
I think there is many inconsistencies in the application	17 (85%)	2 (10%)	1 (5%)	7,75±0,78
In my opinion, most people will easily learn the application quickly	19 (95%)	1 (5%)	0	8,62±0,60
I find the application impractical to use	20 (100%)	0	0	8,62±0,51
I feel confident using the application	17 (85%)	2 (10%)	1 (5%)	8,12±0,85
I need to learn very much before I start using the application	14 (70%)	1 (5%)	5 (25%)	6,37±1,14
Total Response	179 (89,5%)	11 (5,5%)	10 (5%)	
Total SUS Score				80,5±7,25

Table 2. Distribution of changes on children's dietary intake

Variable	*Baseline*	*Endline*	Differences	*p*
Energy (kkal)				
Mean	1217.32	1320.41	103.08	0.050
Min	622.90	766.70		
Max	2863.00	1651.40		
SD	364.52	193.99		
Mean % EAF	96.78	114.02	17.24	
Protein (g)				
Mean	43.68	45.04	1.36	0.516
Min	82.30	26.50		
Max	82.30	74.00		
SD	13.47	10.00		
Mean %PAF	206.24	205.87	-0.37	
Fat (g)				
Median	44.92	48.5	3.58	0.925
Min	18.50	21.30		
Max	150.10	89.80		
IR	17.15	20.65		
Median %FAF	99.0	107.0	8.0	
Carbohydrate				
Mean	152.03	183.18	31.15	0.000*
Min	74.60	105.90		
Max	295.30	233.10		
SD	49.48	27.83		
Mean %CAF	74.81	95.39	20.58	
Fiber				0.023*
Mean	6.37	7.81	1.44	
Min	1.00	3.10		
Max	18.79	13.00		
SD	3.83	2.67		
Mean %FAF	37.80	43.63	5.83	
Iron (mg)				0.148
Mean	5.54	4.87	0.67	
Min	1.60	2.30		
Max	25.90	8.70		
SD	3.79	1.49		
Mean %FeAF	58.55	51.10	7.45	
Vit A (RE)				0.001*
Mean	802.14	1182.48	380.34	
Min	141.0	9.80		
Max	2933.94	3805.4		
SD	469.91	586.55		
Mean %VaAF	178.70	254.01	75.31	

*Paired sample t test, Wilcoxon test significant p<0,05

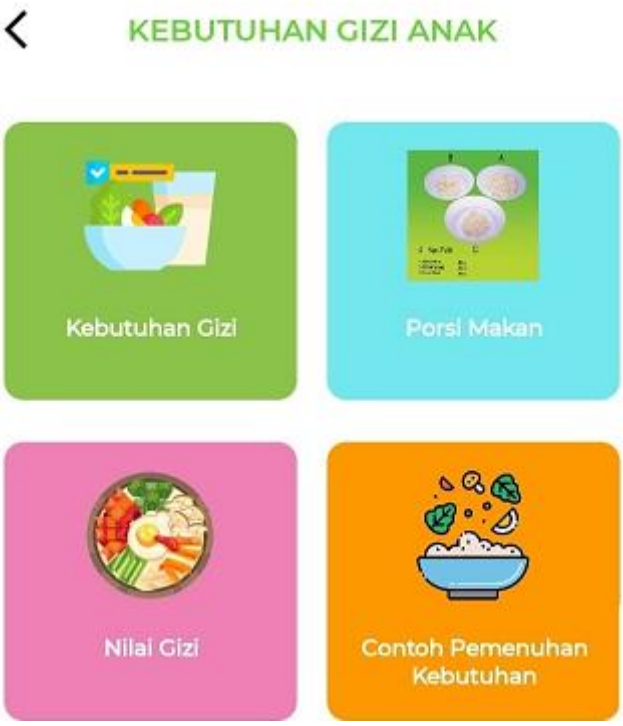

Figure 1. Menu of nutrition requirements from Pegia eHealth

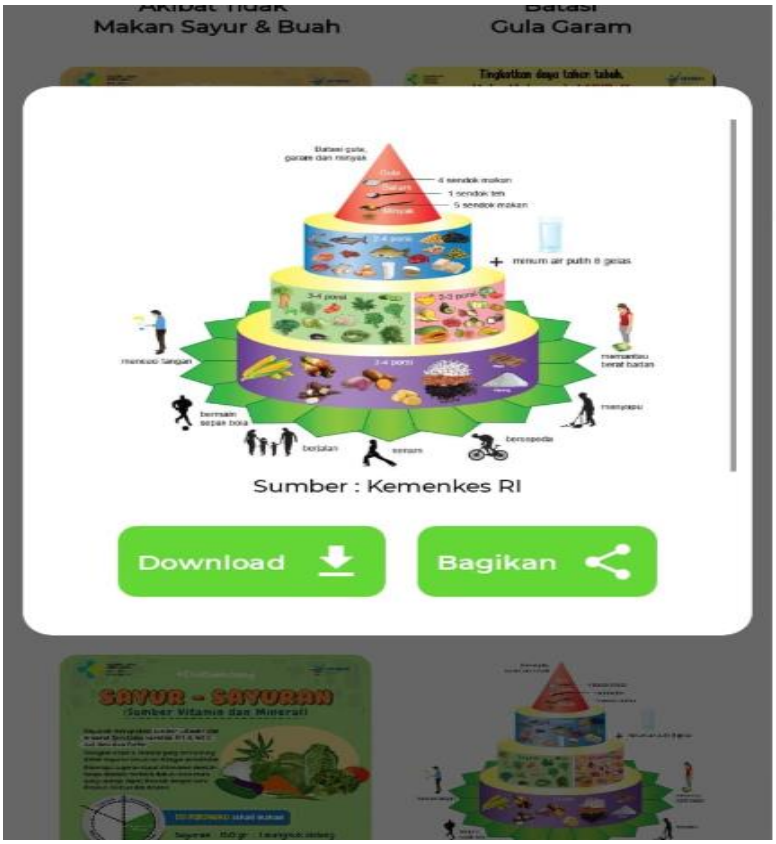

Figure 2. The Balanced nutrition poster from Pegia eHealth

After usability testing of eHealth Pegia was conducted and it was declared acceptable, eHealth Pegia was used as an intervention medium for mothers. There was an increase in maternal feeding practices, especially the choice of type and amount of food given to children after acessing Pegia eHealth. There was an increase in servings from carbohydrate sources from 2-3 servings to 3-4 servings, as well as an increase in servings of vegetables from 1-2 servings to 3-4 servings. The provision of fruit also increased from 1-2 servings to 2-3 servings. Increasing portions of fruit results in a decrease in children's sweet food and drink from 5-6 portions to 3-4 portions a day, include cake, soft drink, siroop and chocholate. Table 2 is the distribution of changes in children's dietray intake before and after the intervention. The analysis indicated a significant increase ($p<0.05$) in dietary intake for carbohydrates, fiber, and vitamin A by 31.5 g, 1.44 g, and 380.07 RE. Referring to Cornwal [20] parents' increased understanding and practice of nutrition after receiving nutrition education occurs because they realize that these changes have positive impacts on children's health. A systematic review conducted by Zarnowiecki [21] on 9 e-Health applications showed that parents desired credible information and engaging platforms for effective e-Health interventions. Taylor [22] showed that e-Health intervention for mothers can increase vegetable consumption and fiber intake in children. A systematic review by Wolfenden [23] analyzed different interventions to improve vegetable and fruit consumption in children. eHealth interventions were found to be effective in the short term (12 weeks) and increased vegetable and fruit consumption in children. According to Haszard[24], children who are guided to eat healthily will consume more vegetables and fruits while reducing the consumption of sweet foods.

4. Conclusions

Pegia eHealth is acceptable to be used as an intervention medium. The intervention of Pegia eHealth can improve maternal feeding practices and dietary intake on children.

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