

# Development of Food Pyramid Game Tools as a Stimulation of Balanced Nutrition Knowledge for Children Aged 5-6 Years

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## Abstract

Balanced nutritional status in early childhood affects growth and development. Children's knowledge about balanced nutrition will affect the application of nutritional information in everyday life. The purpose of this research is to produce a food pyramid game tool product that is feasible according to material experts, media experts, user experts, small-scale tests, and field tests as well as teaching materials in stimulating balanced nutritional knowledge of children aged 5-6 years. This research includes development research (RnD) with the SYNTHESIS model which includes: 1) Needs analysis, 2) Identify aspiration model, 3) Develop initial model, 4) Expert test, 5) Small scale test, and 6) Field test. The small-scale test involved 6 group B kindergarten children, while the field test used 24 group B kindergarten children. The results showed that the food pyramid game tool showed very feasible results, this can be seen from the percentage of material experts 82.9%, media experts 83.5%, user experts 93.6%, small scale tests 100%, and field tests 95.8%. The validation results show that the food pyramid game tool is categorized as very feasible to be used as a stimulation of balanced nutritional knowledge for children aged 5-6 years.

**Keywords:** Playground Equipment; Food Pyramid; Balanced Nutrition

## 1. Introduction

Nutrition plays an important role in the growth and development of early childhood, where its components and existence are indispensable in the body, especially in the process of physical growth and development, the nervous system and brain, as well as the level of intelligence and intelligence of children for future life. According to Law no. 36 of 2009, health is a state of physical, mental, spiritual or social health that allows a person to live in social and economic prosperity (Priyo Titus et al., 2017). Therefore, health must be created in accordance with human ideals and dignity by consuming good nutrition from an early age. The main source to support optimal child activity requires good nutrition, so that children will have the opportunity to do more activities with their environment (Rukmini Syahleman, 2018). Nutrition education has the main goal for early childhood so that they learn nutritious and balanced food (Kurnia, 2014). The process of growth and development of early childhood nutritional status is very influential, because the lack of consuming nutritious food is a factor that directly affects the physical, mental, and intellectual growth of children. While indirect factors can be seen from the economic conditions of the family, namely parental education, parental employment, number of children, knowledge and parenting (Putri et al., 2015).

Good nutritional status can help children's growth and development process optimally. The food consumed by children will affect the growth and development of their bodies. If balanced nutrition is not fulfilled properly in the body, then growth and development will occur nutritional problems. In Indonesia and other developing countries, malnutrition and protein

deficiency (PEM) is a health problem that still occurs frequently. The results of the Indonesian Nutrition Status Survey (SSGI) state that the prevalence of stunting status is 21.6%, the prevalence of wasting status is 7.7%, the prevalence of underweight status is 17.1%, and the prevalence of overweight status is 3.5% (Kemenkes, 2022). The need to develop nutritional knowledge in children to apply balanced nutrition in early childhood. Balanced nutrition contains nutrients in the type of amount that suits the body's needs by taking into account the principles of diversity and variety of foods, physical activity, hygiene, and body weight (Buruk et al., 2021). Lack of nutritional knowledge can affect application in everyday life. The introduction of balanced nutrition is necessary for children's knowledge of the differences between nutritious and non-nutritious foods, as well as clean and unclean foods in consuming daily food.

Game tools for the introduction of balanced nutrition in early childhood in institutions made with educational game tools in education are not yet available, so far schools have only implemented learning the introduction of nutrition through bringing lunch to school, conducting cooking classes which are carried out once a semester, habituation of washing hands before and after eating, monitoring children's growth and development by local health center officers, and only socializing 4 healthy 5 perfect food to children. Game tools are needed in learning because the world of children cannot be separated from playing children are more likely to spend their time playing this can be seen in everyday life. One of the early childhood learning models is playing, through playing early childhood children get meaningful motion and information experiences by being introduced to knowledge, good attitudes through skills, social skills, friends, and the environment (Pramono et al., 2018). Designing educational game tools educators can make decisions with educational requirements, technical requirements, and aesthetics (Yasbiati, M. P., & Gandana, 2018). This problem was found in three institutions based on observations and interviews at Brawijaya 1 YASRI Kindergarten, Muslimat NU 10 Kindergarten, and Tunas Kusuma Kindergarten have not implemented learning using game tools for the introduction of balanced nutritional knowledge.

Research and development of food pyramid game tools continues to complement products that have been carried out by previous research. The first previous research entitled "Development of PIRAMASE (Healthy Food Pyramid) Media for Learners in Elementary Schools" this study found that it can increase understanding of healthy food material as well as being useful as a simple, cheap, clear, and easy-to-implement nutrition education tool (Nursoba et al., 2023). The second study entitled "PGS Placeboard Media and Posters in Nutrition Counseling on Balanced Nutrition Knowledge of Elementary School Students" in the second study found that the PGS placeboard media was more effective in increasing nutritional knowledge (Trianasari et al., 2018). Then the third study with the title "Development of Smart Educational Games Choosing Nutritious Foods Based on Android" in the study obtained the results of educational games providing an indirect and more interesting learning process (Rizki et al., 2023). Of the three previous studies still have some shortcomings in improving nutritional knowledge of early childhood.

Based on the above research, researchers are motivated to develop food pyramid game tools to provide knowledge about balanced nutrition to early childhood about healthy food. The food pyramid game tool developed helps students in choosing healthy and nutritious food,

made of impraboard material coated with magnetic paper and equipped with attractive colors for board design, images of healthy food components made of magnets to attach to the board, there is a sequence card for the game with a guide to how to play, and there are baskets and play money that will be as if early childhood will shop. There is a goal in this study to produce a food pyramid game tool product that is feasible according to material experts, media experts, and expert users in learning.

## 2. Method

### 2.1. Research Method

The type of development research is Research and Development (R&D). This development uses the SYNTHESIS model which consists of six stages, namely: 1) Needs analysis, (2) Identify aspiration model; (3) Develop initial model; (4) Expert test; (5) Small scale test; and (6) Field test. The synthesis development model is carefully examined against models that have been tested, there are six steps in the formulated synthesis development model. The following are the steps of developing a synthesis model (Pramono et al., 2019)

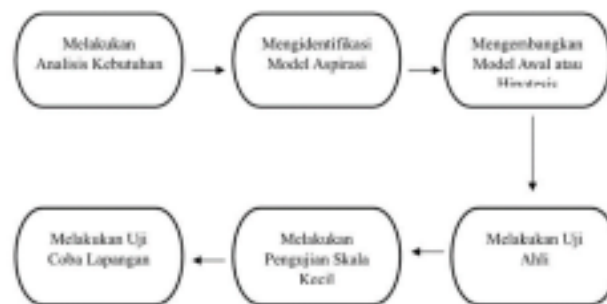


Figure 1. Chart of Development Model According to Pramono (2019)

### 2.2. Location and Time of Research

The research trial Brawijaya 1 Kindergarten, Muslimat NU 10 Kindergarten, and Tunas Kusuma Kindergarten. The small-scale trial was conducted with 6 children at YASRI Brawijaya 1 Kindergarten on May 3, 2024, while the field trial was conducted at 2 institutions, namely Muslimat NU 10 Kindergarten on May 4, 2024 and Tunas Kusuma Kindergarten on May 6, 2024 with a total was conducted in three institutions, namely YASRI of 24 children.

### 2.3. Data Collection Technique

Data obtained from material experts, media experts, and user experts in the form of quantitative data in the form of questionnaires and qualitative data in the form of data containing criticism and suggestions for improvement. Data on research and development that is analyzed is data from the validation results of material experts, media experts, user experts and trial results to analyze the feasibility of developing products. The data collection techniques used are observation, interviews, documentation, and

questionnaires.

### 2.4. Data Analysis Techniqu

The results of the validation of material experts, media experts, and user experts in the form of a questionnaire that refers to the Likert scale, from the questionnaire the respondent will assess the statements that have been given and calculated to get a total score and then calculated into a percentage.

**Table 1. Likert Scale Feasibility Test**

Description	Bobot niai
Very Good	5
Good	4
Fair	3
Not Good	2
Very Bad	1

**Source: Sugiyono (2020) & Hilmi, (2016)**

The validation scoring assessment from experts to assess the feasibility of the food pyramid game tool product is converted into a percentage using the formula (Akbar, 2017).

$$Vah = \frac{Tse}{Tsh} \times 100\%$$

Description :

Vah = Validity (Media experts, Material experts, and Users)

Tse = Total empirical score (acquisition)

Tsh = Total expectation score

Quantitative data on children's questionnaires can be calculated using a guttman scale The scale obtained two answer options, namely "yes" will get a value of 1 while "No" will get an answer of 0 (Sugiyono, 2020). The results of the children's questionnaire were converted into a percentage with the formula from (Arikunto, 2011).

$$P = \frac{\sum x}{N} \times 100\%$$

Description:

P = Percentage Score

$\sum x$  = Number Of Points

N = Maximum Number Of Points

The percentage results of expert questionnaires and children's questionnaires obtained validation criteria or product feasibility of food pyramid educational game tools.

**Table 2. Percentage criteria for validity**

Value Achievement Criteria (Feasibility)	Eligibility Level
81,00%-100,00%	Very feasible to use without revision
61,00%-80,00%	Reasonable, usable but needs minor revisions
41,00%-60,00%	Inadequate, needs major repairs, recommended not to be used
21,00%-40,00%	Not suitable, cannot be used
00,00%-20,00%	Not suitable for use

Source: (Akbar, 2017)

### 3. Results and Discussion

#### 3.1 Result and Discussion

Product development of food pyramid game tools obtained needs and problem analysis data after observation and interviews conducted at the beginning of the research with the principal. The following are the results of the product development process of the food pyramid game tool. **The needs analysis stage carried** out by researchers is data collection through observations and interviews regarding problems and needs at three institutions in Malang City, these institutions are Brawijaya 1 YASRI Kindergarten, Muslimat NU 10 Kindergarten, and Tunas Kusuma Kindergarten in group B (5-6 years). The needs analysis was conducted in January-February 2024. This supports researchers to develop game tools that involve children to be active and understand material related to balanced nutrition and healthy food. Therefore, researchers made a "Food Pyramid" game tool with material containing healthy foods and balanced nutritional content that was made as interesting as possible to stimulate balanced nutritional knowledge for children aged 5-6 years.



**Figure 1. Brawijaya 1 YASRI Kindergarten interview, Muslimat NU 10 Kindergarten interview, and Tunas Kusuma Kindergarten interview**

Interviews were conducted to obtain information about the problems that exist in the institution. It was found that the problems that occur in the institution are, the institution has not implemented learning the introduction of nutrition with game tools, the institution only introduces it with a cooking class which is held once a semester, bringing lunch to school, washing hands before and after eating, health monitoring which

is carried out once a semester by the nearest health center, and socialization of healthy food 4 5 perfect.

**The identification stage of the aspiration model**, namely, the food pyramid game tool is designed according to the needs of children, namely there is material and also games that support children's knowledge of balanced nutrition. Designing the product development of the food pyramid game tool begins with preparing the design and then designing the content of the material to be developed in the game tool. After designing the design, the researcher designs the basic materials for making food pyramid boards, and healthy food components that are safe and durable. making game tools with reference to the product specifications that have been designed. The first design is designing a food pyramid board design.



**Figure 2. Food Pyramid Board Design**

The picture above shows a food pyramid game board made of impraboard with magnets. There are 4 layers of food components from the bottom level to the top, namely carbohydrates. The second layer contains fruits and vegetables, the third layer contains protein, and the last layer is salt, sugar, oil. Each picture of a healthy food component will be given a magnetic attachment to be attached to the board. Then there is a card design for how to use and the sequence to play the game.



**Figure 3. How-to Cards and Sequence Cards**

The picture above is the media that will be used to help use the food pyramid game tool, namely there are sequence cards accompanied by procedures for use, there are

baskets that will be used for children to shop, and toy money used for food buying and selling games.

**The stage of developing the initial model, namely,** the product developed in the form of a game tool “Food Pyramid” which is a game tool that can be used as a support for educators in stimulating balanced nutrition for children aged 5-6 years. As for some parts of the food pyramid game tool as follows.

**a. Food Pyramid Board**

The food pyramid board presents an 80x60 cm board equipped with a tripodframe, which is made of impraboard coated with zinc and stickers with a picture of the food pyramid containing the content (carbohydrates, vegetables, fruit, protein, salt, sugar, and oil) and the number of servings a day consumed.



**Figure 4. Food Pyramid Board**

**b. Components of Healthy Food**

The component image consists of healthy foods accompanied by four tiers, the first tier is carbohydrates, the second tier is vegetables and fruits, the third tier is protein, and the fourth tier is salt, sugar, oil. The components within each tier consist of carbohydrates (potatoes, bread, corn, cereals, tubers, cassava, noodles, wheat, and rice), the next component is fruits and vegetables (mustard greens, tomatoes, garlic, eggplant, broccoli, carrots, cabbage, mushrooms, papaya, watermelon, grapes, strawberries, oranges, apples, pineapple, and bananas), the third component of protein contains vegetable and animal protein (red beans, green beans, tofu, tempeh, fish, chicken, meat, eggs, cheese, and milk), the last component contains salt, sugar, and oil. Each level has a portion that is consumed in a day. Pictures of these components will later be pasted on the food pyramid board.



**Figure 5. Components of Healthy Food**

### **c. Baskets, Containers and Toy Money**

Baskets, containers, and play money in this game tool are used as tools for games in the food buying and selling session. The basket is for the food components that the child will pick and choose, the container is for putting the food components after being purchased by the child, then the play money is to be given to the seller after receiving the healthy food components which will later be attached to the food pyramid board.



**Figure 6. Baskets, Containers and Toy Money**

### **d. User and Sequence Usage Card**

The use and sequence cards on the food pyramid game tool contain usage guidelines and sequence of attachment numbers for healthy food components that will be attached to the food pyramid board adjusted to the sequence card obtained. The user and sequence cards have a size of 12cm x 7.8cm. The usage guide card contains learning objectives and usage steps accompanied by a QR Code for using the food pyramid game tool, while the card contains numbers and meanings at the healthy food level.



**Figure 7. User and Sequence Usage Card**

**The stage of conducting expert tests, namely,** expert tests are carried out to analyze the data obtained during the research. The data generated from the development of food pyramid game tools as a stimulation of balanced nutritional knowledge is obtained from the results of product evaluations to material experts, media experts, and user experts (teachers) to determine the feasibility of products for children aged 5-6 years before being tested on a small scale and field trials.

#### **a. Material Expert Validation Results**

Material expert validation was carried out by 2 material experts. There are two aspects of assessment in terms of education and presentation with statements developed from both aspects of the assessment into 14 statement points. The results of the material expert validation obtained a score of 116 with a maximum score of 140 and had a percentage score with an average of 82.9%. The percentage is included in the criteria with a vulnerability of 81.00%-100.00%, so that the food pyramid game tool is declared “very feasible” to use based on the perspective of the review of the game tool by the material experts.

Based on the material expert validation, there are criticisms and suggestions for improvement. The sentence of the game card is simplified, the learning objectives in recognizing balanced nutrition are clarified, and a video guide for using the game tool is added. This is in accordance with the opinion of Nuryati (2022) which states that educational game tools are a means of conducting play activities in which there is educational value. Thus, based on the results of the calculation of material expert validation, when interpreted in the feasibility category, it falls into the range of 81.00%-100.00% with a very feasible category and can be used without revision.

#### **b. Media Expert Validation Results**

Media validation experts there are two experts who will validate the game tool product. The aspects used are aspects of assessment in terms of design and presentation with statements developed from both aspects of assessment into 17 statement points. the results of the media expert validation obtained an overall score of 142 with a maximum score of 170 and has a percentage score with an average of 83.5%. This percentage is included in the criteria with a vulnerability of 81.00%-100.00%. So that the results of the acquisition of the assessment of the food pyramid game tool are declared “very feasible”

to use based on the perspective of the assessment of the game tool by media experts.

Criticisms and suggestions obtained at the validation of media experts 1 and 2 that need to be corrected, namely the sentence of the game card game rules is clarified, the writing of the card is clarified, fix the cut display logo, and the writing of the food content is less large. This is in line with Mukhtar's research (2018) which argues that children play using real game tools, through playing children can recognize colors, sizes, light weight, fine rough, grouping of objects, characteristics and properties of objects. Through play tools children can explore the surrounding environment and knowledge of themselves (self knowledge).

### c. User Expert Validation Results

User validation was carried out by three educators. The assessment was carried out with the aim of knowing the feasibility of the food pyramid product that the researchers developed as well as being a stage of identification and analysis of deficiencies which would later be used as revision material. There are four aspects of assessment, namely design, education, presentation, and benefits with statements developed from the four aspects of assessment into 19 statement points. Quantitative data on the acquisition of the total score regarding the feasibility of the product obtained a score of 267 with a maximum score of 285. The score on the user expert results was then calculated using the percentage formula and obtained a percentage with an average of 93.3%. The percentage results in the user validation results table are in the range of 81.00%-100.00% including very feasible to use without revision.

criticism and suggestions for improvement by user experts, namely the writing of healthy food levels on the food pyramid game board should be enlarged to make it easier for children to see from a distance of 5 meters after the media is improved, it can be considered feasible to use. The results of user expert validation can be said to be very feasible seen from the percentage score obtained. This is said to be feasible to use, namely in terms of design attracting children's interest from the shape, color, and materials used in the food pyramid game tool. In terms of education, the material learned is easy to understand in accordance with the objectives and is able to increase children's balanced nutritional knowledge. in terms of presentation, children are happy in learning. Then the benefits help children improve communication and learn independently. This agrees with the research of Isnaningsih et al., (2022) that the benefits of educational game tools can stimulate cognitive development, train independence, train discipline, train communication, and increase children's enthusiasm for learning. besides that the food pyramid game tool product can help educators in delivering subject matter.

**The small-scale trial phase** was conducted by 6 children at Brawijaya 1 YASRI Kindergarten. The following are the results of the feasibility test after using the food pyramid game tool.

**Table 3. Small Scale Test Feasibility Results**

Indicator Number	Value	Maximum Value	Percentage (%)	
			Yes	No
1	6	6	100	0
2	6	6	100	0
3	6	6	100	0
4	6	6	100	0
5	6	6	100	0
6	6	6	100	0
7	6	6	100	0
8	6	6	100	0
9	6	6	100	0
10	6	6	100	0
11	6	6	100	0
Total	66	66	100%	0

Based on small-scale feasibility test activities carried out on group B students (5-6 years). Obtained quantitative data from 11 indicators of student achievement assessment got a percentage of 100%. Where the percentage is in the range 81.00%-100.00%, it is stated that the product used can be categorized as very feasible to use without revision. The food pyramid game tool product is declared very feasible to use based on the results of the small scale feasibility test.

The field trial stage is the last stage of testing which aims to see the feasibility of food pyramid products developed by researchers.

**Table 4. Field Test Feasibility Results**

Indicator Number	Value	Maximum Value	Percentage (%)	
			Yes	No
1	24	24	100	0
2	24	24	100	0
3	20	24	83,3	16,7
4	21	24	87,5	12,5
5	22	24	91,7	8,3
6	24	24	100	0
7	24	24	100	0
8	24	24	100	0

9	22	24	91,7	8,3
10	24	24	100	0
11	24	24	100	0
<b>Total</b>	<b>253</b>	<b>264</b>	<b>95,8%</b>	<b>4,1%</b>

Field test activities carried out by 24 group B students (5-6 years) in two institutions obtained quantitative data on the feasibility of using game tool products as in table 4.8 above getting a percentage of 95.8% with a total of 11 indicator assessment points with a value of 256. Based on the range of criteria included in 81.00%-100.00%, it is categorized as very feasible to use without revision. Based on the results of the field test, the food pyramid game tool product is declared very feasible to use.

#### 4. Conclusion

Food pyramid game tool products with balanced nutrition and healthy food material get validation results by several experts, namely material experts, media experts, user experts, and assessments from students after using game tools. The results of material expert validation with an average percentage value of 82.9% are included in the very feasible category and can be used without revision. Media expert validation gets results with an average percentage value of 83.5% with a very feasible category and can be used without revision. User expert validation gets results with an average percentage value of 93.3% with a very feasible category and can be used without revision. The food pyramid game tool product can be widely distributed according to the needs of each institution. Before the product is disseminated, it should be evaluated first and then socialized to related parties such as schools. The food pyramid game tool can be used by educators and group B students in other institutions.

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