



THE EFFECTIVENESS OF SENSORY FLASHCARD MEDIA AND CLASSIFICATION ON KNOWLEDGE OF FRUIT AND VEGETABLE CONSUMPTION AMONG SIXTH-GRADE STUDENTS

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ABSTRACT

Fruits contain a broad range of essential nutrients, including proteins, fats, and carbohydrates, while vegetables serve as vital plant-based foods that help meet daily nutritional needs. Gorontalo Province is among the regions in Indonesia with the lowest fruit and vegetable intake, with 92.5% of the population not meeting the recommended ≥ 5 servings per day. This study aimed to assess the effectiveness of flashcard-based education in improving knowledge of fruit and vegetable consumption among sixth-grade students at State Elementary School 59, East Gorontalo City. This research employed a quantitative approach using a quasi-experimental one-group pretest–posttest design. A total of 35 sixth-grade students were selected through purposive sampling. Research instruments included a closed-ended questionnaire with structured items and predetermined response options. Prior to data collection, the questionnaire underwent validity testing using Spearman’s rank correlation, where items with $r\text{-count} > r\text{-table}$ ($p < 0.05$) were considered valid. Reliability testing was conducted using Cronbach’s Alpha, and all constructs achieved coefficients ≥ 0.70 , indicating acceptable internal consistency. Data were analyzed using the Wilcoxon test, followed by the Kruskal – Wallis test with Post Hoc analysis. The results showed a significant improvement in students’ knowledge after the flashcard educational intervention, with a p -value of 0.000. Interactive learning media such as flashcards enhanced students’ engagement, concentration, and comprehension, enabling them to better understand the nutritional benefits of fruits and vegetables through play-based learning activities. Flashcard-based education is effective in increasing students’ knowledge of fruit and vegetable consumption and serves as an engaging learning tool to support nutritional education in schools.

Keywords: flashcards; fruits; knowledge; nutrition education; vegetables

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INTRODUCTION

Elementary school children are considered a nutritionally vulnerable group because they are in a period of relatively rapid growth, during which they require a substantial amount of essential nutrients (Ahmad, 2021). Nutritional intake at this age is often inadequate due to various environmental factors that strongly influence children's eating behaviors. Poor dietary habits among school-aged children can lead to nutritional problems (Dwi W. & Dwi S., 2020). The World Health Organization (WHO) in 2017 recommended the daily consumption of 400 grams of fruits and vegetables for a healthy life, consisting of 250 grams of vegetables and 150 grams of fruit. Low fruit and vegetable intake poses serious public health concerns. It not only increases the risk of non-communicable diseases but also reflects poor global dietary patterns (Adventus et al., 2020). Ideally, fruit and vegetable consumption should follow the balanced nutrition guidelines 3–4 servings of vegetables and 2–3 servings of fruit per day, or half of the plate consisting of fruits and vegetables (with a greater portion of vegetables) at each meal (Darmawati et al., 2020).

Gorontalo Province is one of the regions in Indonesia with the lowest fruit and vegetable consumption. Data show that 92.5% of the population, based on age groups, does not meet the recommended ≥ 5 servings of fruits and vegetables per day per week. Among individuals aged \geq

10 years, the proportion meeting the recommended intake across districts/cities in Gorontalo Province is only 3.8%, with the highest rate recorded in Gorontalo City (6.9%) and the lowest in Bone Bolango (2.2%). When viewed by age groups, only 3.2% of individuals aged 10 – 14 years, 2.6% aged 15 – 19 years, and 2.2% aged 20 – 24 years consume ≥ 5 servings per day per week. These figures highlight the essential role of fruit and vegetable intake in supporting the growth and development of school-aged children, particularly those in elementary school (Indonesian Health Survey, 2023). Nutritional education can be delivered through various methods, one of which is educational media (Dananjaya, 2020). The use of media is crucial because it helps convey messages more attractively and makes them easier to understand (Fadhillah et al., 2022). Therefore, it is important to develop appropriate educational media that enables elementary school children to learn nutrition in an engaging and enjoyable way (Hamulka et al., 2018).

Flashcards are one form of illustrated learning media designed to support memory and comprehension. They typically consist of two sides—one containing a question, word, or picture, and the other containing the answer or explanation (Dananjaya, 2020). Flashcards can be incorporated into play-based learning activities and are useful in developing children's affective aspects, particularly in introducing fruits and vegetables to school-aged children (Hoerudin, 2023). Based on these considerations, this study aims to examine the effectiveness of sensory and classification-based flashcard educational media in improving knowledge of fruit and vegetable consumption among sixth-grade students at State Elementary School 59, East Gorontalo City.

METHOD

This study employed a quantitative approach using a quasi-experimental design with a one-group pretest–posttest structure. In this design, an initial measurement (pretest) was conducted before the intervention, followed by a posttest measurement after the flashcard-based educational treatment. The sample consisted of 35 sixth-grade students from State Elementary School 59, East Gorontalo City, selected through purposive sampling. The dependent variable in this study was students' knowledge of fruit and vegetable consumption, while the independent variable was the flashcard media, which included sensory-based and classification-based flashcards. Data on the dependent variable were collected using a structured questionnaire, whereas the independent variable was delivered through the flashcard intervention. Data analysis was performed using SPSS and included univariate analysis to describe frequency distributions, followed by bivariate analysis using the Wilcoxon test to assess pre–post changes in knowledge, and subsequently the Kruskal–Wallis test with a post hoc analysis.

The study was conducted at State Elementary School 59, East Gorontalo City, during September 2025. The study population consisted of all sixth-grade students (aged approximately 10–12 years), and the final sample included 35 students who met the inclusion criteria. Research instruments included a closed-ended questionnaire with structured items and predetermined response options. Prior to data collection, the questionnaire underwent validity testing using Spearman's rank correlation, where items with $r\text{-count} > r\text{-table}$ ($p < 0.05$) were deemed valid. Reliability testing was conducted using Cronbach's Alpha, and all constructs achieved coefficients ≥ 0.70 , indicating acceptable internal consistency. Data collection techniques included questionnaire administration, preliminary observations, and document review. Data analysis consisted of univariate procedures to describe distribution patterns and bivariate analysis using the Wilcoxon signed-rank test to assess changes between pretest and posttest scores. The Kruskal–Wallis test followed by post hoc comparisons was used to evaluate differences in knowledge improvement across intervention components.

RESULT

Table 1.
Pre-Test Analysis of Pre-Educational Knowledge Using Sensory Flashcard Media in Grade VI Students

Category	f	%
Enough	3	8.6%
Less	32	91.4%

Table 1 shows that from the results of the pre-test of knowledge using Indera flashcard media, out of 35 respondents there were 3 respondents or equivalent (8.6%) included in the category of sufficient related knowledge, with the category of less than 32 respondents or equivalent (91.4%) who lacked knowledge.

Table 2.
Analysis of Pre Test knowledge before education using flashcard media classification (Sorting Flashcard) in grade VI students

Category	f	%
Good	2	5.7%
Enough	9	25.7%
Less	24	68.6%

Table 2 shows that from the results of the pre-test of knowledge using the classification flashcard media of 35 respondents, there were 2 respondents or equivalent (5.7%) included in the category of good related to knowledge, then with the sufficient category there were 9 respondents or equivalent (25.7%) and there were 24 equivalent respondents (68.6%) with the category of lack of knowledge about fruit and vegetable consumption.

Table 3.
Pre test and post test analysis of Indera flashcard media (Sensory Flashcard) on fruit and vegetable consumption knowledge in grade VI students

Category	Flashcard of the Senses (Knowledge)				p-value
	Pre test		Post test		
	f	%	f	%	
Less	32	91.4%	0	0%	0,000
Enough	3	8.6%	1	2.9%	
Good	0	0%	34	97.1%	

Table 3 shows that there is a significant change between the results of the pre test and post test in students after being educated using sensory flashcard media. In the pre-test stage, most of the respondents showed a lack of knowledge, namely there were 32 respondents with a low category (91.4%), then there were 3 respondents (8.6%) with a sufficient category about the importance of fruit and vegetable consumption. By being educated using sensory flashcard media, the results of the post test were obtained with 34 respondents (97.1%) with the good category and 1 respondent with the good category, this shows a P-value of 0.000. These results when compared to the value of 2 sig tiled 5% (0.05), the $p\text{-value} \leq 0.05$ shows a difference in knowledge before and after being given education about fruit and vegetable consumption using sensory flashcard media.

Table 4.
Analysis of pre-test and post-test of classification flashcard media (Sorting Flashcard) on knowledge of fruit and vegetable consumption in grade VI students.

Category	Classification Flashcard (Knowledge)				p-value
	Pre test		Post test		
	f	%	f	%	
Less	19	54.3%	0	0%	0,000
Enough	15	42.9%	0	0%	
Good	1	2.9%	35	100%	

Table 4 shows that there is a significant change between the results of the pre-test and post-test in students after being educated using classification flashcard media. In the pre-test stage, most of the respondents showed a lack of knowledge, namely there were 19 respondents with a low category (54.3%), then there were 15 respondents (42.6%) with a sufficient category and 1 respondent

(2.9%) with a good category about the importance of fruit and vegetable consumption. By being educated using the classification flashcard media, the results of the post test were obtained with 35 respondents or equivalent (100%) with a good category about the importance of fruit and vegetable consumption. this shows a P-value of 0.000. These results when compared to the value of 2 sig tited 5% (0.05), the p-value ≤ 0.05 shows a difference in knowledge before and after being given education about vegetable consumption.

Table 5.

Results of the post hoc pairwise comparisons test on the variables that have the most influence on the knowledge of fruit and vegetable consumption in grade VI students

Compared media pairs	Test Statistic	Std. test statistic	Sig.	Adj. sig
Flashcard indera	-16,600	-2,643	0.050	0.303
Flashcard Classification	-25,457	-3,000	0,003	0,016

Table 5 above shows the results of the Wallis Cross-Examination with a post hoc follow-up test on the knowledge of fruit and vegetable consumption in grade VI elementary school students where from the two educational media compared, there was a significant difference in the value of pairwise comparisons, it was seen that the classification flashcard media (80.89) had the highest score and the Adj. Sig value (0.016), this shows that this media is the most influential or effective between the two types of flashcard media that Tested. So that the Kruskal Wallis test with the post hoc follow-up test was used to find out whether there was a significant difference between several media on knowledge and attitudes of fruit and vegetable consumption in grade VI students of public elementary schools 59 eastern cities. With this, it means that the classification flashcard media used has a different influence on increasing knowledge and attitudes of fruit and vegetable consumption. Because when further analysis was carried out, it was found that the flashcard media classification was the most influential compared to other flashcard media.

DISCUSSION

Pre-test Knowledge Before Receiving Flashcard-Based Education on Fruit and Vegetable Consumption Among Sixth-Grade Students

Pre-test Knowledge Using Sensory Flashcards

Based on the pre-test results, students' knowledge assessed using sensory flashcards showed that 91.4% of students had poor knowledge regarding fruit and vegetable consumption, while 8.6% fell into the fair category. These findings indicate that the majority of students had insufficient understanding of the importance of consuming fruits and vegetables for maintaining health. This also reflects the limited exposure of students to engaging and age-appropriate nutrition education materials. These results are consistent with a study conducted by Putri (2019) among elementary school children at SD Agussalim, East Jakarta, which found that students' nutrition knowledge before receiving educational intervention was generally low. Many children still did not understand the importance of consuming fruits and vegetables, even though these foods contain essential nutrients necessary for school-aged children. Similarly, research by Muzzaki (2019) among fifth-grade students at SDN Cikoneng revealed that most children did not fully understand the benefits of fruits and vegetables for health, the types that should be consumed, or the recommended daily intake. Many students viewed fruits and vegetables merely as side dishes rather than essential foods required for health and growth.

Pre-test Knowledge Using Classification Flashcards

The pre-test results using classification flashcards showed that 68.6% of students were in the poor knowledge category, while 25.7% were in the fair category. Classification flashcards are visual learning tools containing pictures and information about various fruits and vegetables grouped according to specific characteristics such as color, type (fruit or vegetable), nutrient content, or health benefits. In this study, the media aimed to enhance students' understanding of the importance of fruit and vegetable consumption through interactive and enjoyable learning. During the pre-test stage, the flashcards were used to measure students' initial knowledge before the educational

intervention. The results revealed that most students could only recognize fruits and vegetables at a basic level, without understanding their nutrient content or the reasons they need to be consumed daily. These findings align with a study by Anggraini and Widodo (2021), who used classification flashcards featuring colorful and attractive images at SDN 2 Karanganyar. During the pre-test, students could recognize only a few commonly consumed fruits and vegetables. After flashcard-based learning, students' knowledge increased by 40%, demonstrating that simple tools such as flashcards are effective in helping children categorize foods based on nutritional value.

Post-test Knowledge After Receiving Flashcard-Based Education on Fruit and Vegetable Consumption Among Sixth-Grade Students

Post-test Knowledge Using Sensory Flashcards

Post-test results showed a significant improvement, with 100% of students achieving a good level of knowledge on fruit and vegetable consumption after receiving education through sensory flashcards. The post-test findings highlight the change in students' understanding after participating in the flashcard-based learning. Sensory flashcards typically contain visually appealing images and explanations related to the five senses, designed to be easily understood by elementary students. After the educational intervention, the post-test demonstrated a substantial increase in knowledge, indicating that sensory flashcards effectively helped students learn about the functions, components, and ways to maintain the five senses in a more enjoyable manner. These results support the findings of Putri (2019), who reported that using illustrated flashcards in the lesson theme "My Body" significantly improved students' knowledge of sensory functions. Prior to the intervention, many students could not differentiate the functions of each sense, but post-test results showed an average knowledge increase of 35%. Similarly, Siregar and Yuliana (2021) found that colorful flashcards with simple text enhanced children's memory and understanding of sensory concepts. Post-test results showed significant improvement, especially in students' ability to correctly identify each sense and its function.

Post-test Knowledge Using Classification Flashcards

Post-test results from the classification flashcard intervention also showed a significant improvement, with 100% of students achieving a good level of knowledge. The discussion of these results focuses on how students' understanding increased after receiving education using this visual medium. Classification flashcards help students group objects such as fruits and vegetables based on shared characteristics. After the educational intervention, the post-test results revealed a significant improvement, showing that classification flashcards made the learning process more interactive and easier for students to understand. Statistical testing showed a p-value of 0.000, indicating a highly significant effect. Although all four media used in the broader study influenced students' fruit and vegetable consumption knowledge, post hoc analysis showed that classification flashcards produced the greatest impact, with a comparison value of 83.4, demonstrating stronger effectiveness than other flashcard types. This is consistent with a study by Nugraheni (2020), which found that flashcard use in the theme "Healthy Foods" significantly improved students' knowledge. Before the intervention, students could not classify foods into healthy and unhealthy categories, but post-test scores increased by an average of 40% after flashcard-based learning. This demonstrates that visual classification activities help children grasp concepts more deeply.

CONCLUSION

Based on the findings of this study, it can be concluded that nutrition education using flashcard media has a significant impact on improving students' knowledge and attitudes regarding fruit and vegetable consumption among sixth-grade students at State Elementary School 59, East Gorontalo City. The use of sensory flashcards was shown to effectively enhance students' understanding, with a significance value of $p = 0.000$. Similarly, education using classification flashcards also demonstrated a significant effect on students' knowledge and attitudes toward fruit and vegetable consumption, with a p-value of 0.000. Furthermore, the results of the post hoc pairwise comparisons

indicate that the classification flashcard was the most influential media in improving students' knowledge, with a significance value of $p = 0.016$. These findings highlight that visual learning tools, particularly classification flashcards, can serve as effective educational strategies for improving nutrition literacy among elementary school children.

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