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## Improving Elementary School Students' Food Literacy Through Interactive Digital Media: A Classroom Action Research Approach

Badratun Nafis\*

\* Universitas Serambi Mekkah

E-mail [badratunnafis@serambimekkah.ac.id](mailto:badratunnafis@serambimekkah.ac.id)

Maulidar \*\*

\*\* Universitas Serambi Mekkah

E-mail [maulidar@serambimekkah.ac.id](mailto:maulidar@serambimekkah.ac.id)

Deni Indrawan \*\*\*

\*\*\* STAI Darul Falah

E-mail [deniindrawan1998@gmail.com](mailto:deniindrawan1998@gmail.com)

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### ABSTRACT

*The problem of low student understanding of healthy food concepts in elementary schools is a major challenge in the learning process, mainly due to the use of conventional methods that are not very interesting. This study aims to improve student learning outcomes through the application of interactive learning media on healthy food material. Using the Kemmis and McTaggart Classroom Action Research (CAR) model, this study was conducted in two cycles, each consisting of planning, action, observation, and reflection stages. The research subjects were 25 fifth-grade students at SDN 05 Banda Aceh, who were selected purposively. The results showed a significant increase in the average student learning outcomes, from 65.2 at the beginning to 84.6 in Cycle II. This increase was also in line with a surge in the learning completeness rate from 32% to 92%, which demonstrated the effectiveness of interactive media in helping students achieve learning standards. It can be concluded that interactive learning media proved to be effective in improving student learning outcomes and participation in learning about healthy food. The implication of this study is that interactive media can be adopted as an innovative learning strategy in line with student characteristics and modern educational demands.*

**Keywords:** Learning Outcomes, Interactive Media, Elementary School

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### ABSTRAK

Permasalahan rendahnya pemahaman siswa terhadap konsep makanan sehat di sekolah dasar menjadi tantangan utama dalam proses pembelajaran, terutama akibat penggunaan metode konvensional yang kurang menarik. Penelitian ini bertujuan untuk meningkatkan hasil belajar siswa melalui pengembangan dan penerapan media pembelajaran interaktif pada materi makanan sehat. Menggunakan metode Penelitian Tindakan Kelas (PTK) model Kemmis dan McTaggart, studi ini dilaksanakan dalam dua siklus, yang setiap siklusnya terdiri dari tahap perencanaan, tindakan, observasi, dan refleksi. Subjek penelitian adalah 25 siswa kelas V SDN 05 Banda Aceh yang dipilih secara purposif. Hasil penelitian menunjukkan adanya peningkatan signifikan pada nilai rata-rata hasil belajar siswa, yaitu dari 65,2 pada kondisi awal menjadi 84,6 pada Siklus II. Peningkatan ini juga sejalan dengan lonjakan tingkat ketuntasan belajar dari 32% menjadi 92%, yang menunjukkan efektivitas media interaktif dalam membantu siswa mencapai standar pembelajaran. Selain itu,

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aktivitas dan partisipasi siswa juga mengalami peningkatan, dari kategori 'kurang' menjadi 'sangat baik', seiring dengan pengenalan media interaktif. Dapat disimpulkan bahwa media pembelajaran interaktif terbukti efektif dalam meningkatkan hasil belajar dan partisipasi siswa pada pembelajaran materi makanan sehat. Implikasi dari penelitian ini adalah media interaktif dapat diadopsi sebagai strategi pembelajaran inovatif yang sejalan dengan karakteristik siswa dan tuntutan pendidikan modern.

Kata Kunci: Hasil Belajar, Media Interaktif, Sekolah dasar

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## INTRODUCTION

Health education is a crucial component in shaping children's understanding of nutrition and healthy lifestyle choices. Recent national and global reports indicate that nutritional issues among school-aged children remain a pressing concern (Saavedra & Prentice, 2023). UNICEF (2023) reports that one in three Indonesian children faces nutritional problems such as stunting, underweight, or obesity (Soetono & Barokah, 2024). Similarly, the Ministry of Health (Kemenkes, 2022) emphasizes that unhealthy eating patterns among elementary students largely stem from limited food literacy and inadequate exposure to effective nutrition education. This situation highlights the need for improved pedagogical approaches that not only deliver information but also actively engage students in understanding the concept of healthy food (Ramlah, 2021).

In many Indonesian elementary schools, including preliminary observations at SDN 05 Banda Aceh, healthy food material is still taught using conventional, teacher-centered methods that rely heavily on verbal explanations. These practices tend to produce passive learning, low student engagement, and superficial comprehension. This aligns with findings from previous studies indicating that students in the concrete operational stage require concrete, visual, and interactive learning experiences to construct meaningful understanding (Marinda, 2020). Therefore, integrating more engaging and interactive media becomes essential to support deeper conceptual learning.

Interactive learning media offer potential solutions to these challenges. Literature on technology-enhanced learning consistently shows that multimedia-based instruction can improve student motivation, conceptual understanding, and learning outcomes. Mayer's Cognitive Theory of Multimedia Learning (CTML) explains that learning improves when information is delivered through integrated visual and verbal channels following principles such as coherence, signaling, and redundancy (Mayer, 2024). Additionally, constructivist learning theory emphasizes that students construct knowledge through active engagement, exploration, and reflection—conditions that are naturally facilitated by interactive media (Cavanagh & Kiersch, 2023). Frameworks such as TPACK Sihanita (2024) and SAMR (Blundell et al., 2022) further provide pedagogical justification for meaningful technology integration, demonstrating how multimedia tools can transform traditional learning.

Empirical evidence from Indonesian studies also supports the effectiveness of interactive media in elementary classrooms. Utomo (2023) and (Chafshah (2024) highlight that digital and interactive media improve engagement and learning performance. Pristy & Sukartono (2023) found that interactive presentations enhance students' conceptual mastery in science materials, while Marcheilla (2025) demonstrated that technology-driven learning can promote digital literacy and creativity. Specifically related to nutrition content, Fitria (2022) and Sugiwati (2023) show that multimedia-based learning tools can improve students'

understanding of health-related concepts. However, these studies still lack integration with international theoretical foundations such as CTML, constructivism, TPACK, and SAMR. They also do not specifically address the problem of improving healthy food literacy in elementary school through a structured classroom action research design.

At the international level, recent reviews show significant interest in digital nutrition interventions for children, highlighting the role of interactive technologies in shaping dietary behaviors (Talens dkk., 2025; van der Heijden dkk., 2024). However, these studies emphasize broader interventions rather than classroom level, curriculum integrated practices. Thus, there remains a gap in understanding how theoretically grounded interactive media can directly enhance healthy food learning outcomes within the elementary school context in Indonesia .

To address this gap, the present study integrates interactive digital media specifically the application “Makanan Sehatku”, which features animations, drag-and-drop classification, interactive quizzes, and nutrition-based simulations into the teaching of healthy food material. This media is intentionally designed in alignment with the principles of multimedia learning (Mayer), active learning (constructivism), and technology integration models (TPACK and SAMR). Such theoretical grounding ensures that the media not only functions as a visual aid but also as a pedagogical tool that transforms learning processes. Therefore, this study aims to: improve students’ learning outcomes on healthy food material through the use of theoretically grounded interactive media, enhance student learning activities and engagement during the learning process; and demonstrate how interactive media can be meaningfully integrated into classroom practices to address persistent gaps in food literacy education. By situating this research within strong theoretical foundations and empirical gaps, this study contributes a novel and practical solution for improving nutrition education in Indonesian elementary schools.

## **METHODS**

### **Type and Design**

This study employed a mixed-methods Classroom Action Research (CAR) design using the Kemmis and McTaggart spiral model, which consists of planning, action, observation, and reflection phases conducted in two cycles (Kurniawan, 2017). The qualitative component was dominant through observations, field notes, and documentation, while quantitative data derived from pre-test, post-test, mean scores, mastery levels, and N-gain supported the measurement of learning improvements. CAR was selected because the research sought to solve an authentic instructional problem and test the effectiveness of an interactive media intervention in a real classroom context. The design was also informed by multimedia learning theory, constructivist learning principles, and technology integration frameworks to ensure a theoretically grounded intervention.

### **Data and Data Sources**

#### **Participants**

Participants consisted of 25 fifth-grade students of SDN 05 Banda Aceh during the 2024/2025 academic year, selected through purposive sampling based on the identified learning difficulties related to healthy food material.

### **Student Characteristics**

Participants were 10–11 years old, comprising 13 females and 12 males, with heterogeneous academic performance and basic-to-moderate digital literacy. These characteristics align with the suitability of interactive multimedia for students at the concrete operational stage.

### **Data Types**

Two categories of data were collected:

1. Quantitative data: pre-test and post-test scores, class means, mastery percentages, and N-gain.
2. Qualitative data: observation notes, documentation (photos and videos), and teacher field notes.

### **Data collection technique**

#### **Learning Achievement Test**

Learning outcomes were measured using a 15-item multiple-choice test administered as both pre-test and post-test in each cycle. The test covered three domains: identifying healthy and unhealthy food, classifying nutrients, and applying balanced diet principles. *Example item:* “Which of the following food combinations represents a balanced breakfast?”

**Validity and Reliability**, Content validity was evaluated by three experts, yielding a Content Validity Index (CVI) of 0.89. Reliability was assessed using the KR-20 formula, resulting in a coefficient of 0.78, indicating acceptable internal consistency.

#### **Observation Sheet**

Student activity was assessed using an observation sheet with five indicators: enthusiasm, participation in discussions, ability to operate interactive media, collaboration, and discipline. Two observers conducted simultaneous observations. Inter-rater reliability measured using Cohen’s Kappa produced a coefficient of 0.82, indicating strong agreement.

#### **Documentation**

Supporting qualitative data were collected through photographs, videos, and teacher field notes throughout each cycle.

#### **Procedure**

The study was carried out in two cycles with the following steps:

##### **Cycle 1**

Planning involved preparing lesson plans and instruments and validating the media and tools. The action phase utilized the “Makanan Sehatku” interactive media, integrating animations, drag-and-drop tasks, quizzes, and simulations. Observations recorded student activity during the learning process. Reflections identified issues, including limited participation and unclear instructions.

##### **Cycle 2**

Improvements were made through clearer scaffolding, refined group arrangements, and enhanced use of interactive features. The cycle followed the same sequence of planning, action, observation, and reflection to evaluate progress and determine the effectiveness of the intervention.

#### **Data analysis**

##### **Quantitative Analysis**

Quantitative data were analyzed using mean scores, mastery percentages, and normalized gain (N-gain) to evaluate learning improvement.

Mean Score:

$$X = \frac{\sum x}{N}$$

Mastery Learning Percentage:

$$P = \frac{\text{Students achieving} \geq \text{KK}}{N} \times 100\%$$

Normalized Gain (N-gain)

$$g = \frac{(\text{Post} - \text{Pre})}{(100 - \text{Pre})}$$

### Qualitative Analysis

Qualitative data were analyzed using the Miles and Huberman procedures of data reduction, data display, and conclusion drawing. Triangulation was conducted by comparing observation results, documentation, and field notes to ensure credibility of the findings.

## RESULTS AND DISCUSSION

### RESULT

#### Initial Conditions (Pre-Cycle)

Initial measurements were conducted through a pre-test and classroom observations under conventional learning conditions. The results revealed that students' understanding of healthy food concepts was still low. Most students were unable to distinguish between healthy and unhealthy foods and had limited understanding of essential nutrients.

Table 1. Initial Learning Outcome Data

No	Value Range	Frequency	Percentage	Category
1	90-100	0	0%	Very Good
2	80-89	3	12%	Good
3	75-79	5	20%	Fair
4	60-74	12	48%	Poor
5	<60	5	20%	Very Poo
<b>Total</b>		<b>25</b>	<b>100%</b>	
<b>Average</b>			<b>65,2</b>	
<b>Comple</b>		<b>8</b>	<b>32%</b>	
<b>tion rate</b>				

Based on the data, only 8 out of 25 students (32%) achieved the Minimum Passing Grade (75), with a class average of 65.2. This indicates a clear need for instructional innovation to enhance students' conceptual understanding.

#### Cycle I Results

Cycle I involved the use of the interactive application "Makanan Sehatkku", which includes drag-and-drop features for classifying foods, interactive quizzes, and animated explanations of nutritional content. The learning approach shifted toward a more **student-centered** model, where the interactive media played a central instructional role. Learning

Outcomes Cycle I Post-test results demonstrated meaningful improvement compared to the pre-cycle condition:

Table 2. Learning Outcomes Data for Cycle I

No	Value Range	Frequency	Percentage	Category
1	90-100	2	8%	Very Good
2	80-89	8	32%	Good
3	75-79	6	24%	Fair
4	60-74	7	28%	Poor
5	<60	2	8%	Very Poo
<b>Total</b>		25	100%	
<b>Average</b>			76,4	
<b>Comple</b>		16	64%	
<b>tion rate</b>				

Based on the table above, the average score increased from 65.2 to 76.4 and learning completeness rose from 32% to 64% (16 students completed the course). Although it has not yet reached the target of 80% completeness, this increase shows that interactive media is beginning to have a positive impact.

Next, student learning activities were observed through five indicators. The results can be seen in Table 3 below.

Table 3. Student Activity Observation Data Cycle I

No	Activity Indicator	Average Score	Category
1	Enthusiasm in learning	3,2	Good
2	Active participation in discussions	2,8	Good
3	Ability to operate media	3,0	Good
4	Cooperation in groups	2,9	Good
5	Discipline during learning	3,1	Good
<b>Average Total</b>		<b>3,0</b>	<b>Good</b>

Based on Table 3 above, the average student activity score was 3.0 (category "Good"). The indicator with the highest score was enthusiasm (3.2), while discussion participation (2.8) was the lowest. This shows that although interest in learning has increased, the ability to express opinions and actively participate still needs to be improved.

## Cycle II Results

Improvements in Cycle II were made based on reflections from Cycle I, namely: Adding tiered quizzes to the application, integrating animated videos about the impact of unhealthy foods, forming more heterogeneous study groups to encourage interaction, and increasing teacher guidance to encourage discussion.

Table 4. Learning Outcomes Data for Cycle II

No	Value Range	Frequency	Percentage	Category
1	90-100	7	28%	Very Good
2	80-89	12	48%	Good
3	75-79	4	16%	Fair
4	60-74	2	8%	Poor

5	<60	0	0%	Very Poo
<b>Total</b>		25	100%	
<b>Average</b>			84,6	
<b>Comple tion rate</b>		23	92%	

Based on the table above, the results show a significant improvement, namely: the average score rose to 84.6, learning completeness reached 92% (23 students), and no students scored below 60. Furthermore, students began to be able to explain the reasons for food grouping, understand important nutrients, and give examples of application in everyday life.

Furthermore, learning activities in cycle II also showed a significant increase, as shown in the following table:

Table 5. Student Activity Observation Data Cycle II

No	Activity Indicator	Average Score	Category
1	Enthusiasm in learning	3,8	Very Good
2	Active participation in discussions	3,6	Very Good
3	Ability to operate media	3,7	Very Good
4	Cooperation in groups	3,5	Very Good
5	Discipline during learning	3,6	Very Good
Average Total		3,6	Very Good

Based on the table above, the average activity increased to 3.6 (category "Very Good"). The highest indicator was enthusiasm (3.8), indicating that interactive media was very effective in motivating students. Discussion participation also increased dramatically from 2.8 to 3.6, showing that the heterogeneous group strategy was successful.

### Comparison of Results Between Cycles

To provide a comprehensive overview of the effectiveness of interactive media in teaching healthy food material, we conducted a comparative analysis of the results from the initial condition (pre-cycle) to Cycle II. This comparison covers three main aspects: average learning outcome scores, learning completion rates, and student activity scores. The data shows consistent and significant progress in each cycle. The average class score increased by 17.1% from the pre-cycle to Cycle I, and by 10.7% from Cycle I to Cycle II, resulting in a total increase of 29.75% from the initial condition. The percentage of learning completeness showed a more dramatic increase, from 32% to 92%, or an increase of 187.5%. Student activity also improved significantly, from the "poor" category to "very good". A summary of the comparison of results between cycles is presented in the following recapitulation table.

Table 6. Recapitulation of Learning Outcomes Between Cycles

Aspect	Pre-Cycle	Cycle I	Cycle II	Improvement
<b>Average Score</b>	65,2	76,4	84,6	29,75%
<b>Mastery</b>	8 student (32%)	16 student (64%)	23 student (92%)	187,5%
<b>Student Activity</b>	2,1 (Less)	3,0 (Good)	3,6 (Very Good)	71,4%

These results show consistent improvement in all indicators, both cognitive and learning activities. Interactive media intervention has been proven to have a significant impact.

## DISCUSSION

The results of this study indicate that the use of interactive digital media had a significant impact on improving students' understanding of healthy food concepts. The increase in the average score from 65.2 (pre-cycle) to 84.6 (cycle II) and the rise in mastery from 32% to 92% demonstrate that the learning intervention was highly effective in strengthening conceptual comprehension.

Findings in this study are consistent with recent Indonesian research showing that interactive digital media is capable of enhancing student motivation, engagement, and academic performance in elementary schools. Isfandira (2018) found that animation-based interactive media increased students' motivation and encouraged active participation in the learning process. Similarly, Taroreh (2024) reported that digital interactive media significantly improved conceptual understanding in science learning at the primary level, aligning with the improvement in the student activity scores in this study (from 3.0 to 3.6).

The improvement in student behavior and engagement is also supported by Indonesian studies emphasizing that interactive multimedia creates more meaningful learning experiences. Erdawati & Sartika (2022) highlight that e-learning and interactive applications promote better understanding because they enable students to visualize abstract concepts and receive immediate feedback, similar to the drag-and-drop and animated content used in this research.

Furthermore, the increased student participation during group discussions – shown by the rise from 2.8 to 3.6 is consistent with research by Radityan (2014), who demonstrated that interactive multimedia fosters collaboration and communication among elementary learners. The digital features used in this study functioned not only as learning aids but also as scaffolding tools that guided students to explore, classify, and analyze food content more independently, consistent with the findings of Heryani (2022), who emphasized that digital media strengthens active learning behavior.

Overall, this study reinforces the growing body of Indonesian literature that supports the integration of interactive digital media in primary education. However, this study contributes uniquely to the local field by focusing on healthy food literacy, an area that remains minimally explored in Indonesian elementary school contexts. The results show that interactive media can serve as an effective pedagogical tool for improving both conceptual understanding and student engagement in health-related topics.

## CONCLUSION

This study concludes that the use of interactive digital media significantly enhanced elementary students' understanding of healthy food concepts, as shown by improvements in both learning outcomes and learning activities across cycles. The consistent increase from an initial average score of 65.2 to 84.6 in Cycle II and from 32% to 92% mastery demonstrates that interactive media can effectively support conceptual learning in health-related topics. These findings strengthen the growing body of Indonesian research that highlights the effectiveness of digital learning tools for improving motivation, engagement, and academic performance at the primary level.

Beyond empirical findings, this study contributes to the educational knowledge base by providing evidence that interactive digital media can be successfully integrated into food literacy instruction in elementary schools an area that remains insufficiently explored in Indonesian contexts. The results also reinforce theoretical perspectives that emphasize the importance of visual-interactive learning experiences in supporting conceptual formation and active participation among young learners.

The study carries several pedagogical implications. Teachers are encouraged to incorporate interactive multimedia tools to foster student engagement, facilitate conceptual understanding, and support collaborative learning. Schools may also consider implementing digital learning ecosystems that integrate interactive applications into regular classroom practice, especially for topics that require visualization and experiential exploration such as nutrition, science, and health education.

However, this study has limitations that may affect transferability. The research was conducted in a single school with a limited sample size, which may constrain the generalization of results to broader populations. The design of the study being classroom action research also focuses primarily on localized improvement rather than broader external validity. In addition, the study relied heavily on teacher-led interventions, which may influence the effectiveness of the media under different instructional conditions.

Future research may explore the integration of interactive media across diverse school settings, including rural and urban contexts, to examine variations in effectiveness. Further studies could also incorporate larger sample sizes, experimental designs, or longitudinal approaches to capture long-term impacts on food literacy and digital learning skills. Additionally, research can investigate how interactive media can be combined with inquiry-based learning or gamification to deepen engagement and conceptual understanding.

In conclusion, the results of this study affirm that interactive digital media is a powerful pedagogical tool for improving food literacy and fostering active learning in elementary schools. Strengthening the integration of such media in classrooms has the potential not only to enhance learning outcomes but also to support the development of digitally literate, health-aware students – an essential foundation for education in the 21st century.

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