

Enhancing Grade VI Science and Social Studies (IPAS) Learning Activity Using Augmented Reality Media for the Digestive System Topic

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Article history

Submitted: 2026/06/01; Revised: 2026/09/11; Accepted: 2026/10/02

Abstract

This study aimed to improve students' science learning activities through the use of Augmented Reality (AR) media in the topic of the Human Digestive System for sixth-grade students of SD Negeri Karawaci 7. The research employed Classroom Action Research (CAR) based on the Kemmis and McTaggart model consisting of two cycles, with two meetings in each cycle. The participants were 24 students, including 10 males and 14 females. Data were collected through observation sheets assessing learning activities based on five indicators: orientation, problem formulation, hypothesis formulation, data collection, and conclusion drawing. Initial observations indicated that students' learning activities were still low, with an average activity score of 51.50 and a classical mastery level of 12.50%. The findings revealed a continuous improvement in student learning activities throughout the implementation of AR media. The average learning activity score increased from 51.50 in the pre-action stage to 82.71 at the end of Cycle II, representing an increase of 31.21 points. Classical mastery improved from 20.83% to 87.50%, exceeding the predetermined success criterion of 80%. These findings indicate that Augmented Reality media effectively enhances science learning activities among elementary school students.

Keywords

Augmented Reality; Learning Activities; Science; Classroom Action Research; Elementary School; Human Digestive System

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INTRODUCTION

Natural and Social Sciences (IPAS) learning in the Independent Curriculum is designed to develop critical, creative, communicative, and collaborative thinking skills through meaningful learning experiences. In its implementation, learning activities are a key indicator of learning success because they demonstrate student physical and mental engagement during the learning process. High levels of learning activity enable students to more easily grasp concepts, construct new knowledge, and develop skills necessary for the 21st century (Sardiman, 2018; Santos, 2017).

In reality, student learning activities in science lessons remain a problem in

many elementary schools. Some students tend to be passive, participate less in discussions, and are less likely to ask questions or express their opinions during the learning process. This low level of learning activity impacts the quality of conceptual understanding and student learning outcomes (Lawe & Pau, 2019). Study (Dewi et al., 2019) also shows that learning activities have a positive relationship with improving student learning outcomes. One of the science topics that often causes difficulty for students is the Human Digestive System. This topic contains abstract biological concepts because the processes occurring within the human body cannot be directly observed. Therefore, students need learning media that can visualize objects concretely to more easily understand the relationship between the structure and function of the digestive organs (Zahra, 2024).

Using innovative learning media is one solution teachers can implement to enhance student learning activities. Engaging and interactive media can increase student attention, motivation, and engagement in learning activities, making the learning process more effective (Rosyana et al., 2022). Student-centered learning has also been proven to be able to increase the activeness and learning participation of elementary school students (Nuhandini et al., 2025). One of the rapidly developing technologies in education is Augmented Reality (AR). This technology allows virtual objects to be displayed interactively in a real-world environment, providing a more engaging and immersive learning experience for students. The results of the study (Avila-Garzon et al., 2021) shows that the use of AR in education for more than two decades has had a positive impact on student motivation, engagement, and conceptual understanding. Similar findings were also reported by (Saat et al., 2021) which states that AR is able to facilitate the learning process through more concrete and interactive visualizations.

The implementation of technology in science and science learning is in line with the demands of the Independent Curriculum, which encourages the use of digital technology to create meaningful learning experiences (Evitasari et al., 2025) explained that science learning needs to be supported by media that can connect scientific concepts to students' real-life experiences. Therefore, the use of AR is considered relevant to help students understand the abstract concept of the Human Digestive System. Based on initial observations of the science lessons on the human digestive system conducted by the class teacher, student learning activities were still suboptimal. Most students tended to be passive in discussions, were less active in asking questions, and were unable to formulate problems and draw conclusions independently. This situation indicates the need for corrective action through the use

of learning media that can increase student engagement in the learning process.

Several previous studies have shown that the use of digital technology and interactive media can significantly increase student learning activities (Avdiu et al., 2024) explains that 21st-century learning emphasizes the use of technology as a means of developing critical and collaborative thinking skills. Therefore, the use of Augmented Reality media is seen as having the potential to enhance elementary school students' science learning activities. Based on the description, this study aims to improve science learning activities using Augmented Reality (AR) media on the Human Digestive System material for sixth grade students of Karawaci 7 Elementary School.

METHODS

This research uses the Classroom Action Research (CAR) method, Kemmis and McTaggart model, which consists of planning, action, observation and reflection stages in each cycle.(Arikunto et al., 2021). PTK was chosen because it aims to improve the quality of learning directly through actions carried out by teachers in the classroom (Utomo et al., 2024). The research was conducted at Karawaci 7 Public Elementary School in the odd semester of the 2026/2027 academic year. The subjects were 24 sixth-grade students, consisting of 10 boys and 14 girls. The research was conducted in two cycles, each consisting of two meetings on the human digestive system topic, using the Problem-Based Learning (PBL) model assisted by Augmented Reality (AR) media through the Assemblr Edu application. During the planning stage, the researcher developed a sixth-grade science teaching module, prepared learning media in the form of AR markers depicting the human digestive system, presentation materials, student worksheets (LKPD), and observation instruments for learning activities. Furthermore, the researcher developed a PBL-based learning scenario tailored to the research objectives.

In the action phase, learning is carried out using AR media that allows students to observe three-dimensional models interactively. Learning activities are carried out according to the syntax of Problem-Based Learning (PBL), which includes problem orientation, investigation, group discussion, presentation of results, and conclusion of the material. In the observation phase, observers observe students' learning activities during the learning process using prepared observation instruments. In the reflection phase, researchers and observers analyze the observation results and evaluate the implementation of learning in each cycle. The results of the reflection are used to determine improvements in actions in the next cycle so that students' learning activities can be optimally improved. The

implementation of the actions in Cycle I focused on the human digestive system organs and their functions, as well as the process of food movement through the body. Students worked in groups to observe visualizations of the digestive organs, discuss problems, and complete the provided student worksheets. Reflection results from this cycle indicated that limited equipment resulted in unequal opportunities for students to interact directly with AR media.

Based on the results of these reflections, actions in Cycle II were refined through more effective group management, increased access to learning tools, and more structured instruction during the investigation process. Learning in this cycle covered mechanical and chemical digestion, digestive system disorders, and how to maintain digestive health. These improved actions provided more equal opportunities for students to conduct observations, discussions, and presentations, thus enhancing learning activities optimally. The research instrument was a student learning activity observation sheet used by observers to assess student engagement during learning. The observed learning activity indicators included: (1) orientation, (2) formulating problems, (3) formulating hypotheses, (4) collecting data, and (5) formulating conclusions.

Data collection techniques were carried out through observations of students' learning activities at the pre-action stage, Cycle I, and Cycle II using a learning activity observation sheet that had been prepared. Data analysis was conducted quantitatively and descriptively by calculating the average learning activity score and the percentage of classical completion at each meeting. The research success criteria were determined if students achieved a learning activity score of at least 71 and classical completion of at least 80%. The formula below is as follows:

Average learning activity

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

Information:

$\bar{x}$ = average learning activity

$\sum x$ = total score

N = number of students

Classical completion

$$P = \frac{n}{N} \times 100\%$$

Information:

P = percentage of classical completion

n = number of students who completed

N = number of students

FINDINGS AND DISCUSSION

Prior to the implementation of the intervention, the researcher conducted initial observations of the science lessons on the human digestive system conducted by the class teacher. The observations were conducted to obtain an overview of the students' learning activities before the application of Augmented Reality (AR) media. The results of the observations indicated that students' learning activities were still suboptimal. Most students tended to act as recipients of information and were not actively involved in the learning process. Only a few students participated in discussions, asked questions, or provided responses to the material explained by the teacher.

This situation is evident in the low level of student engagement in various observed learning activity indicators. During the problem-orientation stage, some students have not yet demonstrated a strong curiosity about the material being studied. During the problem-formulating and hypothesis-forming stages, students still have difficulty expressing opinions and conveying initial assumptions regarding the human digestive process. Data collection and summarizing learning outcomes have also not developed optimally because learning is still dominated by teacher explanations and limited use of media. Furthermore, the abstract nature of the human digestive system contributes to students' low learning engagement. The digestive organs and processes occurring within the human body cannot be directly observed, making it difficult for students to develop a comprehensive conceptual understanding. As a result, students tend to be passive and simply listen to the teacher's explanation without further exploration of the material.

Based on the results of pre-action observations, the average student learning activity was 51.50 with a classical completion percentage of 12.50%. Of the 24 students, only 3 students achieved the learning activity completion criteria, while the other 21 students had not achieved the minimum activity value set. These results indicate that student learning activities are still in the low category so that corrective actions are needed through the use of more interactive learning media and are able to provide concrete learning experiences. Therefore, Augmented Reality (AR) media was chosen as a solution to improve student learning activities in the human digestive system material.

Table 1. Development of Student Learning Activities

Stage	Average	Completion (%)	Completed	Not yet finished
Pre-Action	51.50	12.50	3	21
Cycle I Meeting 1	56.88	20.83	5	19
Cycle I Meeting 2	66.88	41.67	10	14

Cycle II Meeting 1	76.46	75.00	18	6
Cycle II Meeting 2	82.71	87.50	21	3

Source: Student learning activity observation data.

Based on Table 1, student learning activities experienced a gradual increase from the pre-action stage to the end of Cycle II. In the pre-action stage, the average learning activity was 51.50 with a classical completion of 12.50%. After the application of Augmented Reality media, the average learning activity increased to 56.88 in Cycle I, Meeting 1, with a classical completion of 20.83%. Although the increase was not significant, these results indicate that students are starting to adapt to the use of AR media in learning.

In Cycle I, Meeting 2, the average learning activity increased to 66.88, with a classical completion rate of 41.67%. This improvement indicates that students are beginning to demonstrate greater engagement in the learning process. They began actively observing three-dimensional objects displayed through AR, discussing with group members, and participating in problem-solving activities provided by the teacher. Learning improvements made in Cycle II had a more significant impact on student learning activities. In Cycle II Meeting 1, the average learning activity increased to 76.46 with a classical completion rate of 75.00%. Students appeared more active in asking questions, formulating problems, collecting data, and presenting discussion results. Furthermore, in Cycle II Meeting 2, the average learning activity was 82.71 with a classical completion rate of 87.50%. These results indicate that the research success indicator has been achieved because the classical completion rate has exceeded the minimum limit set at 80%.

Table 2. Summary of Improvement in Student Learning Activities

Indicator	Beginning	End	Improvement
Average Activity	51.50	82.71	31.21
Classical Completion	12.50%	87.50%	75.00%
Students Complete	3 students	21 students	18 students

Source: Researcher's analysis of observation data.

The data in Table 2 shows that the use of Augmented Reality media significantly increased student learning activities. The average learning activity increased from 51.50 in the pre-action stage to 82.71 at the end of Cycle II, representing an increase of 31.21 points. Furthermore, classical mastery increased from 12.50% to 87.50%, while the number of students meeting the mastery criteria increased from 3 to 21. These findings indicate that the use of AR media has a positive impact on student engagement during the science learning process. The findings of this study align with Sardiman's (2018) theory of learning activities, which states that learning will occur optimally if students are actively involved in various learning activities. Learning activities are a form of student involvement,

both physically and mentally, in the learning process. In this study, the use of AR media provides opportunities for students to be directly involved in learning activities through observation, discussion, exploration, and problem-solving. This condition encourages increased student participation throughout the learning process.

Increased learning activity was evident across all observed indicators, namely problem orientation, problem formulation, hypothesis formulation, data collection, and conclusion formulation. During the orientation phase, students demonstrated greater curiosity when observing AR-based visualizations of the digestive organs. During the problem and hypothesis formulation phase, students began actively asking questions and expressing their assumptions regarding the function and working processes of the human digestive organs. Data collection increased when students directly observed three-dimensional objects displayed through AR. Furthermore, students found it easier to draw conclusions because they received a more concrete visual representation of the relationships between organs in the human digestive system.

The results of this study strengthen the findings (Avila-Garzon et al., 2021) which states that Augmented Reality technology can increase student engagement through interactive and immersive learning experiences. Through AR, students not only passively receive information but also interact directly with learning objects, making the learning process more engaging and meaningful. This learning experience encourages students to be more active in exploring the material being studied. The research findings are also in line with (Saat et al., 2021) which explains that the three-dimensional visualizations provided by AR technology help students understand abstract concepts more easily. In the human digestive system topic, students can observe the shape, position, and movement of organs through the body more realistically than using two-dimensional images in textbooks. This ease of visualization encourages increased student activity in observation, discussion, and conclusion-making.

Overall, the increase in students' learning activities from the pre-action stage to the end of Cycle II shows that the use of Augmented Reality media is able to create more active, interactive, and meaningful learning. AR media not only helps students understand the abstract concept of the human digestive system, but also provides a learning experience that encourages student involvement at every stage of science learning. Thus, the use of Augmented Reality media has proven effective in increasing students' learning activities on the human digestive system material in

grade VI of SD Negeri Karawaci 7.

CONCLUSION

Based on the results of the classroom action research that has been carried out, it can be concluded that the use of Augmented Reality media in science learning on the Human Digestive System material can improve the learning activities of sixth grade students of Karawaci 7 Elementary School. AR media provides a more concrete, interesting, and interactive learning experience so that students are more active in observing, discussing, collecting information, and concluding learning outcomes. The application of AR media is able to create more active, interactive, and meaningful learning so that student involvement in the learning process increases significantly. Thus, Augmented Reality media is proven to be effective as an alternative learning media to improve science learning activities in elementary schools.

For teachers, it is recommended to utilize Augmented Reality media more widely in science learning and other subjects that require visualization of abstract concepts so that students are more active and motivated in learning. For schools, it is recommended to provide supporting facilities and infrastructure for digital technology-based learning and provide training to teachers so they are able to develop innovative learning according to the needs of 21st-century students. For further researchers, it is recommended to develop research on the use of Augmented Reality on materials, educational levels, or other variables such as learning motivation, critical thinking skills, and learning outcomes so that broader and deeper findings are obtained.

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