

# The Effectiveness of 3d Hologram Media on Elementary School Students' Learning Outcomes in Natural and Social Sciences (IPAS) Subjects

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## Article history

Submitted: 2026/03/18; Revised: 2026/04/22; Accepted: 2026/05/13

## Abstract

The rapid development and advancement of educational science in the modern era have significantly influenced the growth of the educational sector worldwide. This study aims to determine the effectiveness of 3D Hologram Media on Elementary School Students' Learning Outcomes in Natural and Social Sciences (IPAS) subjects. This type of research is quantitative with an experimental method. The form of the experimental approach with a research design is One-Group Pretest-Posttest. The research sample is 14 people. Data collection techniques and tools use multiple-choice tests, analysis techniques using the "t" test. The results of the calculation of normally distributed data for posttest data show that  $L \text{ count } 0.187 < L \text{ table } 0.227$  and for pretest data it is found that  $L \text{ count } 0.114 < L \text{ table } 0.227$ . The results of homogeneous calculations obtained a value of  $1.409 < 7.879$ . The results of the calculation and analysis of data from the results of hypothesis testing at a significance level of 5% with  $df = 13$  obtained the price of "t" table which is 1.770. The results of hypothesis testing show that  $t \text{ count } > t \text{ table}$  which is proven at a level of 5%, namely  $13.142 > 1.770$ . The data shows that ( $H_a$ ) the alternative hypothesis is accepted, and ( $H_0$ ) the null hypothesis is rejected. Thus, the use of 3D hologram media is effective for student learning.

## Keywords

3d hologram media, effectiveness, learning outcomes, social studies



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## INTRODUCTION

The rapid development and advancement of educational science in the modern era have significantly influenced the growth of the educational sector worldwide. Education plays a crucial role in shaping qualified and competent human resources because it is a conscious and purposeful effort aimed at developing human potential and improving the quality of life. As a deliberate process, education is designed not only to transfer knowledge but also to cultivate skills, values, and attitudes necessary for individuals to function effectively in society. In many countries, including Indonesia, education is regarded as one of the most important instruments

for national development and intellectual advancement. National education is expected to develop students' abilities, character, morality, creativity, independence, and sense of responsibility so they can contribute positively to society and the nation. Therefore, schools are required to implement effective learning systems that can support students in achieving educational goals and obtaining satisfactory learning outcomes (UNESCO, 2021; Biesta, 2020).

Learning outcomes are considered one of the most essential indicators in the teaching and learning process because they reflect students' understanding and mastery of knowledge, attitudes, and skills acquired through instruction. Learning outcomes are generally measured through systematic assessments such as written tests, oral examinations, and performance-based evaluations designed to determine the effectiveness of the educational process. To achieve optimal learning outcomes, a well-organized instructional system is necessary, particularly in formal classroom settings where students and teachers interact directly during learning activities. In this process, students act as the primary participants in learning, while teachers serve as facilitators who guide and support students in constructing knowledge and developing competencies. Effective interaction between teachers and students is expected to create meaningful learning experiences that encourage active participation and deeper understanding of the subject matter (Biggs & Tang, 2011; Hattie, 2012).

In classroom learning, the use of instructional media is highly important because it helps teachers deliver learning materials more effectively and efficiently. Appropriate learning media can serve as an alternative solution to overcome low student achievement and limited student engagement during the learning process. The selection of instructional media should consider the suitability of the media with the learning materials, students' characteristics, and the available learning time. Learning media can create a more conducive learning environment by helping students receive information clearly and systematically. In addition, instructional media function as tools that motivate students, emphasize important concepts, provide learning variations, and improve the structure of classroom instruction. Therefore, teachers are encouraged to integrate innovative and interactive media into classroom activities to support students' understanding and learning motivation (Mayer, 2021; Smaldino et al., 2019).

One of the innovative technologies that can be implemented in classroom instruction is 3D hologram media. The use of 3D hologram technology enables students to visualize and understand complex concepts more easily, especially in subjects such as science, mathematics, and social studies. A 3D hologram is a technology that creates realistic three-dimensional projections of objects by combining information related to shape, size, texture, and lighting to produce images that appear real to viewers. Through direct visualization of 3D objects, students are able to observe learning materials from different perspectives, examine object details more deeply, and understand relationships between concepts more comprehensively. This interactive learning experience can increase students' curiosity, engagement, and conceptual understanding of the topics being studied (Bower et al., 2017; Ibáñez & Delgado-Kloos, 2018).

The implementation of 3D hologram media in learning generally involves several instructional steps, including preparing learning objectives, presenting information, organizing students into learning groups, facilitating collaborative learning activities, and providing recognition or rewards for students' participation and achievement. Based on classroom observations conducted at SD Negeri 03 Trans Batumarta X, fifth-grade students were found to have limited understanding of Natural and Social Sciences (IPAS) concepts. This condition was influenced by the limited use of innovative instructional media and the lack of highly competent educators capable of designing modern teaching media. As a result, many students showed low engagement during classroom instruction, failed to pay attention to teachers' explanations, and even performed unrelated activities during lessons. Such passive attitudes toward IPAS learning contributed to students' low academic achievement and unsatisfactory learning outcomes (Slavin, 2018; Arends, 2012).

The lack of interactive learning media has reduced the effectiveness of the teaching and learning process because students receive limited stimulation and interaction during instruction. Consequently, students become less motivated to understand the learning materials, particularly in IPAS subjects that require conceptual visualization and contextual understanding. To address this issue, the researcher proposes the use of 3D hologram media as an innovative instructional strategy that can make classroom learning more engaging and interactive. The integration of communication technology into classroom activities is expected to improve students' interest, participation, and understanding of the subject matter. Moreover, the implementation of 3D hologram media is considered suitable for IPAS learning because it allows students to explore learning materials visually and interactively, thereby enhancing their comprehension and academic performance. Based on the problems identified during classroom observations and the analysis of students' learning outcomes, the researcher is interested in conducting a study entitled "The Effectiveness of 3D Hologram Media on the Learning Outcomes of Fifth-Grade Students in Natural and Social Sciences (IPAS)" (Clark & Mayer, 2016; Moreno & Mayer, 2007).

## **METHODS**

This study employed a quantitative research approach using an experimental research method. Experimental research is commonly applied in quantitative studies to investigate the effect of a particular treatment or independent variable on a dependent variable under controlled conditions. The purpose of this method is to determine whether the implementation of a specific instructional strategy can significantly influence students' learning outcomes. In this research, the treatment involved the use of 3D hologram media in the learning process to examine its effectiveness in improving students' achievement in Natural and Social Sciences (IPAS). Experimental research is considered appropriate because it allows researchers to measure causal relationships between variables systematically and objectively through statistical analysis (Creswell & Creswell, 2018; Ary et al., 2019).

The population of this study consisted of fifth-grade students at SD Negeri 03 Trans Batumarta X. The total population was 27 students, including students from class V.A and class V.B. The sample used in this study consisted of 14 students selected from the population. The research focused on examining students' learning outcomes after the implementation of 3D hologram media during classroom instruction. By involving elementary school students in the experimental process, the researcher aimed to identify whether innovative technological media could support students' conceptual understanding and increase their academic performance in IPAS learning (Fraenkel et al., 2015; Johnson & Christensen, 2020).

The data collection technique used in this research was a test method. Tests are instruments consisting of questions, exercises, or other assessment tools designed to measure individuals' knowledge, skills, intelligence, abilities, or talents. In this study, the tests were used to determine students' mastery of the learning materials after participating in the instructional activities using 3D hologram media. Before the test was administered, students were first taught using the hologram-based instructional media. After the learning activities were completed, students were given achievement tests to measure their learning outcomes. The purpose of conducting these tests was to compare students' learning performance before and after the implementation of the 3D hologram media in classroom instruction (Brown & Abeywickrama, 2019; Nitko & Brookhart, 2018).

The research instrument used in this study was a test sheet in the form of multiple-choice questions, consisting of pretests and posttests administered before and after the IPAS learning activities. Before being used as the primary research instrument, the test items were first piloted on respondents outside the research sample to examine the validity and reliability of the instrument. The try-out was conducted in class V.B because the class came from the same school environment and had similar characteristics to the research sample at SD Negeri 03 Trans Batumarta X. Conducting an instrument try-out is important to ensure that the test items are appropriate, understandable, and capable of accurately measuring students' learning outcomes (Gay et al., 2012; Cohen et al., 2018).

The data obtained in this study were collected through testing procedures and analyzed quantitatively using descriptive statistical analysis and inferential statistics, particularly the t-test. The t-test was employed to determine whether there was a significant difference between students' learning outcomes before and after the use of 3D hologram media in IPAS learning. Through statistical analysis, the researcher aimed to identify the effectiveness of the instructional media in improving students' academic achievement and supporting a more interactive and meaningful learning experience in elementary school classrooms (Field, 2018; Pallant, 2020).

## **FINDINGS AND DISCUSSION**

Based on the data analysis of students' learning outcomes in the Natural and Social Sciences (IPAS) subject, the findings showed a significant improvement after the implementation of 3D hologram media in the learning process. Before using the 3D hologram media, the average score obtained by students was 81.143, while after using

the media, the average score increased to 94.286. Furthermore, the calculation of the t-test showed that the obtained value of t-count was 13.142, which was higher than the t-table value of 1.770. This result indicates that the alternative hypothesis ( $H_a$ ) was accepted because the value of t-count exceeded the value of t-table ( $13.142 > 1.770$ ). Therefore, it can be concluded that students who learned using 3D hologram media achieved higher learning outcomes compared to their performance before the treatment was implemented. This finding demonstrates that 3D hologram media was more effective in improving students' learning outcomes in the IPAS subject. The use of hologram technology also enabled students to focus more effectively and understand the learning materials more clearly because they could directly observe visual representations of the concepts being taught (Mayer, 2021; Moreno & Mayer, 2007).

Table 1. Recapitulation of Students' Learning Outcomes in IPAS Subject

Group	Highest Score	Lowest Score	Average Score
Before Treatment	95	69	81.143
After Treatment	100	80	94.286

The results of this study confirmed that the use of 3D hologram media was effective in enhancing students' learning achievement. 3D hologram media is a technology that enables the creation of realistic three-dimensional projections of objects that appear visually real to viewers. These holographic projections combine information related to shape, size, texture, and lighting to produce highly interactive visualizations. Through the implementation of 3D hologram media in fifth-grade IPAS learning, students were able to understand the learning materials more effectively and improve their concentration during classroom activities. The visual and interactive nature of hologram technology supports students in observing concepts more clearly and developing deeper conceptual understanding through direct visualization experiences (Bower et al., 2017; Ibáñez & Delgado-Kloos, 2018).

Based on the field research conducted, 3D hologram media also demonstrated several advantages during the learning process. Both teachers and students found it easier to study and understand historical events, scientific concepts, and other learning materials because hologram technology could present visualizations that appeared realistic and alive. The media helped students visualize abstract concepts and made the learning process more engaging and meaningful. As a result, students became more active in solving problems, exchanging information, and participating in collaborative group discussions during classroom instruction. However, several limitations were also identified during the implementation process. When students were not properly guided or supervised, some of them tended to lose concentration during learning activities. Effective learning processes require careful supervision and classroom management to ensure that instructional objectives can be achieved successfully. Therefore, the researcher suggests that teachers continuously guide and monitor students throughout each stage of learning activities while also providing reinforcement and

additional explanations to students who experience difficulties during the learning process. Through proper supervision and instructional guidance, 3D hologram media can be utilized more effectively to improve students' learning outcomes in IPAS subjects (Slavin, 2018; Arends, 2012).

## **CONCLUSION**

Based on the results of the research, data analysis, and discussion, it can be concluded that 3D hologram media was effective in improving students' learning outcomes in the IPAS subject. This conclusion can be observed from the increase in students' average scores, which improved from 81.143 before the implementation of the 3D hologram media to 94.286 after the treatment was applied. In addition, the effectiveness of the media was statistically proven through hypothesis testing, which showed that the value of t-count was greater than the value of t-table at the 5% significance level ( $13.142 > 1.770$ ). These findings indicate that the implementation of 3D hologram media had a positive impact on students' learning outcomes in IPAS learning at SD Negeri 03 Trans Batumarta X. The integration of interactive visualization technology into classroom instruction successfully enhanced students' understanding, engagement, and academic achievement during the learning process (Clark & Mayer, 2016; Hattie, 2012).

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