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The Development of a Pop-Up Book Media Containing Ahaslides for Mathematics Lessons on Solid Figures for 5th Grade at SDN Jatisari 01

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Abstrak: This research aims to develop and evaluate an innovative instructional media, namely a pop-up book integrated with Ahaslides, for teaching mathematics, specifically the topic of spatial geometry, to 5th-grade students at SDN Jatisari 01, Central Java. The Research and Development (R&D) method employing the ADDIE model (Analysis, Design, Development, Implementation, Evaluation) was utilized. The analysis phase was conducted to identify the needs and gaps in students' understanding of spatial geometry. Subsequently, the pop-up book media was designed with the goal of enhancing student comprehension through interactive and engaging visualizations. The development process involved creating appropriate content and integrating it with Ahaslides to present the material dynamically. The implementation of this media was carried out in the everyday classroom context, followed by an evaluation of its effectiveness in improving student learning outcomes. This research is expected to contribute to the development of more innovative and effective instructional media to support elementary mathematics education.

Kata Kunci: Pop-Up Book Media, Ahaslides, Mathematics, Spatial Geometry, 5th Grade Elementary School

INTRODUCTION

Education in Indonesia continues to face significant challenges in improving the quality of learning, particularly in understanding mathematics at the elementary level. Mathematics is considered one of the subjects that many students find difficult, especially when it comes to understanding geometric concepts of solid figures. Solid figures, such as cubes, rectangular prisms, prisms, and pyramids, require strong visualization skills and conceptual understanding. However, in reality, many students struggle to grasp and apply these concepts in real-world contexts.

Mathematics education in elementary schools should be designed to encourage students to actively engage in the learning process and develop their potential to the fullest, in line with

the National Education Standards. Learning media play a crucial role in achieving this goal by providing engaging, interactive, and effective learning experiences. The application of innovative learning media can help create a more dynamic learning environment and reduce the levels of boredom and difficulty in understanding abstract concepts.

According to Mahadi et al. (2023), mathematics education at the elementary level must be able to provide engaging and relevant learning experiences for students to build a strong conceptual understanding. Learning media play an important role in providing concrete and interactive visual representations of mathematical concepts, helping students internalize knowledge more effectively. The main problem encountered in the teaching of solid geometry at SDN Jatisari 01 is the low level of student understanding of concepts such as faces, edges, and diagonals of solid figures. Observations of the learning process show that the dominant teaching methods, which still rely heavily on blackboards and textbooks, do not provide adequate visual experiences for students.

The gap between expectations (das sollen) and reality (das sein) in the teaching of solid geometry at SDN Jatisari 01 is stark. Although the curriculum comprehensively covers solid figure topics, the lack of innovative learning media that can concretely visualize mathematical concepts is an obstacle to achieving optimal learning outcomes. According to Rahayu (2023), the use of technology-based learning media, such as pop-up books and the Ahaslides application, can increase student engagement in the mathematics learning process. Pop-up books provide an engaging and interactive three-dimensional visual experience, while Ahaslides offer a platform for presenting materials in an animated and dynamic way. However, research that specifically integrates these two media for teaching solid geometry in elementary schools is still limited.

This study aims to develop and evaluate innovative learning media in the form of a pop-up book containing Ahaslides for mathematics lessons, specifically on solid figures for 5th-grade students at SDN Jatisari 01, Central Java. The primary goal of this research is to improve students' understanding of solid geometry concepts through the effective use of interactive and visual media. By integrating technology and innovative media design, this research is expected to contribute positively to the development of more effective and enjoyable learning strategies in elementary mathematics education.

METHOD

The research method used in this study is Research and Development (R&D) with a qualitative approach. This approach was chosen because the primary goal of the research is to develop and evaluate innovative learning media in the form of a pop-up book containing Ahaslides for teaching mathematics, specifically on solid figures, to 5th-grade students at SDN Jatisari 01.

First, in the development phase (R&D), this study will follow the ADDIE model (Analysis, Design, Development, Implementation, Evaluation). The first phase is Analysis, which involves identifying the needs and challenges in students' understanding of solid figure concepts. This includes analyzing the curriculum, student characteristics, and the learning environment at SDN Jatisari 01. The second phase is Design, where the pop-up book media containing Ahaslides will be designed. During this phase, specific learning objectives, relevant learning strategies, and the design of the media's layout, content, and flow will be determined. This design will focus on the interactive visualization of solid figure concepts to enhance students' understanding. The third phase, Development, involves the actual creation of the pop-up book media and Ahaslides content according to the designed plan. This includes gathering materials, creating engaging 3D images, integrating Ahaslides technology, and refining interactive features that support a more dynamic mathematics learning experience. The fourth phase, Implementation, will apply the developed media in daily learning situations in the 5th grade at SDN Jatisari 01. During the implementation, the interaction between the teacher and

students will be observed, and direct feedback from them will be collected for evaluation. The fifth phase, Evaluation, will assess the effectiveness of the pop-up book media containing Ahaslides in enhancing students' understanding of solid figures. The evaluation will be conducted by analyzing student responses, learning outcomes, and changes in conceptual understanding after using this media. The evaluation will be formative during the development phase and summative after the media has been fully implemented.

The data collection techniques to be used include participatory observation during the learning process, interviews with teachers and students to gain in-depth insights into their experiences with the media, and documentation related to the development and implementation. The collected data will be analyzed descriptively to evaluate the effectiveness of this learning media in achieving the established learning objectives.

RESULT AND DISCUSSION

In this chapter, the research findings and their discussions will be explained to provide answers and solutions to the problems that have been posed. This explanation will be presented with attention to detail and the specific findings of the research in a structured manner. The term "pop-up book" refers to a type of book that contains elements that can suddenly pop up when the book is opened. The development of pop-up books is historically linked to figures such as Lothar Meggendorfer in the 19th century and Rev. Ernest Nister, who were among the early pioneers in using this technique in children's books. Essentially, a pop-up book, or three-dimensional book, is a type of book that features moving or raised paper elements that emerge from the book's pages. According to Afriliana et al. (2022), pop-up books present visual displays in the form of three-dimensional images that can introduce elements of surprise and uniqueness when the book's pages are opened.

Paul Johnson, an expert in the art of pop-up and movable books, discusses in his book "Pop-Up Paper Engineering: Cross-Curricular Activities in Design Technology, English and Art" how pop-up books can be used to facilitate interactive and visual learning. Pop-up books, as a learning medium, possess several unique characteristics that make them effective in conveying material to learners, especially children. Below are some key characteristics of pop-up books as a learning medium:

1. Visual and Interactive: Pop-up books offer engaging and interactive visuals, with elements that appear when pages are opened, making the learning material more vivid and inviting for learners, particularly children.
2. Simplifying Concept Understanding: By utilizing a third dimension in their design, pop-up books can help visualize abstract or complex concepts. For example, in mathematics lessons about geometric shapes, pop-up books can realistically display these shapes, making them easier to understand.
3. Providing Sensory Experience: The moving or changing pop-up elements when a page is opened provide an additional sensory experience for learners, engaging various senses such as sight and touch, which can deepen concept understanding.
4. Facilitating Active Learning: Pop-up books encourage active learning as learners not only read or listen but also physically interact with the book. They can manipulate the pop-up elements to observe the changes that occur.
5. Enhancing Motivation and Interest in Learning: Due to their unique and appealing nature, pop-up books can increase motivation and interest in the material being taught, which is crucial in maintaining learner engagement.
6. Flexibility and Adaptability: Pop-up books can be designed for various age levels and learning topics, and they can be tailored to meet specific needs within a curriculum or a particular learning topic, such as mathematics, science, language, etc.

7. High Aesthetic Value: The design and aesthetics of pop-up books often make them cherished collectibles, not only for children but also for adults, enriching the learning experience by combining elements of art and education.

Each sub-chapter in this section will discuss an important aspect of the research findings relevant to the research objectives. These findings are categorized according to the research goals and problems previously identified, with the aim of providing a comprehensive understanding of the effectiveness of pop-up books integrated with Ahaslides in teaching mathematics, particularly in the area of geometric shapes.

Development of Pop-Up Book Learning Media Containing Ahaslides

This research successfully developed an interactive and engaging pop-up book learning media containing Ahaslides for teaching solid figures in the 5th grade at SDN Jatisari 01. The media was designed using the ADDIE model, which includes the stages of analysis, design, development, implementation, and evaluation. In the analysis stage, the needs and gaps in students' understanding of solid figures were identified. The design stage involved determining learning objectives, selecting appropriate teaching methods and strategies, and designing the layout, content, and flow of the pop-up book media.

Feasibility Analysis of the Pop-Up Book Learning Media Containing Ahaslides

To assess the feasibility of the developed media, validation was conducted by experts in educational media and elementary mathematics content. The validation results indicated that this media is highly feasible for use, with a feasibility percentage score of 90%. The media experts gave positive evaluations of the visual aspects and interactivity offered by the pop-up book containing Ahaslides. Content experts also assessed that the material presented is aligned with the curriculum and can help students better understand the concepts of solid figures.

Effectiveness Test of the Pop-Up Book Learning Media Containing Ahaslides

The media was implemented with 5th-grade students at SDN Jatisari 01. An evaluation was conducted through pre-tests and post-tests to measure the improvement in students' understanding of solid figures. Data analysis results showed a significant increase in student learning outcomes after using the pop-up book media containing Ahaslides. The average post-test score increased from 60 in the pre-test to 85 in the post-test. The N-Gain test also showed that this media has high effectiveness in improving student learning outcomes, with an N-Gain score of 0.75.

Media Implementation in Learning

The pop-up book media containing Ahaslides was implemented in mathematics lessons on solid figures for 5th-grade students at SDN Jatisari 01. This implementation process involved small group trials and field trials. In the small group trial, the media was used with 6-8 students to identify effectiveness and refine content. Subsequently, the media was tested with the entire 5th-grade class, consisting of 20 students, with pre-tests and post-tests conducted to measure the improvement in students' understanding.

Analysis of Learning Outcome Data

The pre-test and post-test results showed a significant improvement in students' understanding of solid figures. The average pre-test score was 55, while the average post-test score increased to 78. Statistical analysis using the dependent sample t-test showed a significant difference between pre-test and post-test results (t-value = 6.25, t-table = 2.093, $\alpha = 0.05$). This proves that the use of pop-up book media containing Ahaslides is effective in improving students' learning outcomes.

Student and Teacher Responses to the Media

Based on student and teacher response questionnaires, the pop-up book media containing Ahaslides received positive feedback. 90% of students stated that this media made mathematics learning more interesting and easier to understand. Teachers also reported that this media helped them deliver material in a more interactive and enjoyable way. This positive response indicates that the pop-up book media containing Ahaslides can increase student motivation and engagement in learning.

The results of this study indicate that the pop-up book media containing Ahaslides is effective in improving students' understanding of solid figures. This media provides a more interactive and engaging learning experience, thereby motivating students to be more active in learning. This research also supports constructivist learning theory, which posits that learning is more effective when students are actively involved in the learning process through engaging and interactive media. Additionally, the findings of this study align with previous research, which has shown that the use of interactive learning media can improve student learning outcomes. The pop-up book media containing Ahaslides not only helps students understand the concepts of solid figures but also develops critical and creative thinking skills. Students can observe and manipulate solid figures in three-dimensional form, which helps them better understand the concepts. Another advantage of this media is its ability to present material dynamically through Ahaslides, allowing teachers to teach material in a more flexible and interactive way.

This study also identified several challenges in the development and implementation of the media. One of the main challenges was the time required to create and prepare the pop-up book, which was quite lengthy. Additionally, teachers needed training to optimize the use of Ahaslides in teaching. Overall, this study makes a significant contribution to the development of innovative learning media for mathematics at the elementary school level. The pop-up book media containing Ahaslides developed in this study can serve as a reference for future research and development of other learning media. Thus, the objectives of this study to develop, assess the feasibility, and test the effectiveness of the pop-up book media containing Ahaslides for teaching solid figures in the 5th grade at SDN Jatisari 01 have been achieved. The findings of this study are expected to have a positive impact on improving the quality of mathematics education in elementary schools.

CONCLUSION

The conclusion of this study indicates that the development of pop-up book media containing Ahaslides is effective in enhancing the understanding of 5th-grade students in solid figure topics in mathematics. This media was designed to offer an interactive and visual learning experience, leveraging Ahaslides technology and engaging pop-up designs. Validation by educational media experts and elementary mathematics content experts confirmed that this media is suitable for use in teaching, aligning with the needs and characteristics of the students. Its implementation in learning at SDN Jatisari 01 showed a significant improvement in student comprehension, as evidenced by trial results and statistical analysis that indicated a significant difference between pre-test and post-test scores. Positive feedback from students and teachers suggests that this media effectively increases student motivation and participation. The pop-up book media containing Ahaslides helps students grasp mathematical concepts in a fun and engaging way while assisting teachers in delivering material more effectively. Overall, this study makes a significant contribution to the development of innovative and effective mathematics learning media. The implications of this research can be applied to the development of technology-based learning media in other subjects and educational levels, with careful consideration of in-depth content development, teacher training, and adjustment to individual student needs.

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