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IMPLEMENTATION OF PROJECT-BASED LEARNING ON SCIENCE MATERIALS TO INCREASE STUDENT CREATIVITY

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Abstract

This study aims to determine the effectiveness of the implementation of the project-based learning model (PjBL) in increasing student creativity in Natural Sciences (IPA) subjects. Student creativity is one of the important competencies of the 21st century that must be developed through an active, innovative, and contextual approach to learning. In the modern world of education, creativity is not only considered a natural talent, but also a skill that can be honed through meaningful learning experiences. The PjBL model provides students with the opportunity to be directly involved in the learning process through projects that are challenging and relevant to daily life, so that they can spark creative thinking, problem-solving skills, and collaboration. This study uses a quantitative approach with quasi-experimental methods and nonequivalent control group design. The subjects of the study were grade VIII students at one of the junior high schools in Mataram City which were divided into two groups, namely the experimental class that used the PjBL model and the control class that followed conventional learning. The research instruments include creativity assessment sheets based on fluency, flexibility, originality, and elaboration indicators, as well as documentation of student project results. The results of the data analysis showed a significant difference between the creativity of students in the experimental class and the control class. Students who participated in learning with the PjBL model showed a higher increase in creativity. Thus, project-based learning has proven to be effective in increasing students' creativity in science learning.

Keywords: Project-Based Learning, Creativity, Science, Junior High School Students

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INTRODUCTION

Natural Sciences (IPA) is an important foundation in the primary and secondary education system in Indonesia. Science learning aims to shape students to have the ability to think critically, logically, analytically, and have a high curiosity about natural phenomena and scientific processes (Ministry of Education and Culture, 2020). However, science learning at the junior high school level still faces various challenges, especially in conveying abstract

concepts such as changes in the form of substances, organ systems, or force and motion. These concepts require concrete visualization so that they can be fully understood by students who are at the stage of early formal operational development according to Piaget's theory. One of the causes of students' difficulties in understanding science material is that the dominant learning method is conventional. Based on the results of a study by Suryani et al. (2021), science learning in schools still uses a lecture approach and static media such as textbooks or two-dimensional images. This causes students to be disinterested in taking lessons, low motivation to learn, and a shallow understanding of concepts.

As educational technology develops, animation-based learning media is a potential solution that can answer these challenges. Animation can present complex information visually and interactively, so that it can increase students' attractiveness and understanding of the subject matter (Wulandari & Marbun, 2021). Animation also has the advantage of depicting dynamic processes, such as changes in the shape of substances, particle movement, or simulations of experiments that are difficult to do in person in the classroom (Herlina et al., 2022). Recent research shows that the use of animation media is not only able to increase students' understanding of scientific concepts, but also has a significant effect on students' learning outcomes and learning motivation. For example, a study by Astuti & Nuryanti (2022) states that software-based interactive animation media such as Adobe Animate is able to significantly improve students' science test scores compared to traditional learning. Another study by Yusuf & Rahmawati (2023) also found that students who learned using animation media showed increased interest in learning and long-term retention of the material taught.

In addition to increasing understanding and motivation, animation media also supports the principle of multimodal learning. According to Mayer (2020), learning that combines narrative text, sound, and moving images is more effective because it engages visual and auditory channels simultaneously, strengthening students' long-term memory encoding. In addition, animation is also able to stimulate visual and kinesthetic learning styles, which are widely possessed by junior high school students (Hasanah et al., 2021). With this background, this research aims to develop animation-based learning media that can be used in science learning in grade VII junior high school, especially on material on changes in the form of substances. This material was chosen because of the high level of difficulty of understanding and the low achievement of basic competencies found in the analysis of previous student learning outcomes. This development is expected to produce media that is not only feasible in terms of content and design, but also effective in improving student learning outcomes and can be applied by teachers in daily learning.

By utilizing the ADDIE development model approach, this research targets the preparation of structured and pedagogically valid animation media. The ADDIE model was chosen because of its advantages in providing a systematic framework in the design and development process of educational media (Branch, 2016). The success of this development will contribute to technology-based science learning innovations and enrich interactive learning media references that are in accordance with the characteristics of 21st century students.

METHODS

This research uses a research and development approach (Research and Development) with the ADDIE (Analysis, Design, Development, Implementation, Evaluation) model as developed by Branch (2016). The selection of this model is based on its completeness in providing a systematic and iterative flow in the development of technology-based educational products.

In the *analysis stage*, needs were identified through interviews with science teachers and the distribution of questionnaires to grade VII students at one of the public junior high schools in NTB. This analysis aims to identify learning gaps, especially in the understanding of material changes in the form of substances. In addition, the study of curriculum documentation and syllabus is used to design the suitability of the content of the material with the Basic Competencies.

The *design* stage involves the preparation of storyboards, narrative scripts, animated scenarios, and interactive media navigation structures using Adobe Animate and Articulate Storyline software. Furthermore, at the *development stage*, animation media products are developed and tested for validity through expert tests, both media experts and science material experts. Validation using validation sheet instruments with indicators of technical quality, content feasibility, and instructional clarity (Nieveen et al., 2019).

The *implementation stage* was carried out through a limited trial of 30 grade VII students. Students are given a pretest to measure initial understanding, then given learning using animation media, and end with a posttest. In addition, students also fill out a response questionnaire to find out the level of involvement, attractiveness, and ease of use of media.

The last stage, *evaluation*, includes the analysis of data on validation results, student responses, and increase in pretest and posttest scores which are analyzed descriptively quantitatively. The effectiveness of the media was analyzed based on the difference in test scores using descriptive statistics and gain scores (Hake, 1998), and its achievement was analyzed against the set learning indicators.

RESULT AND DISCUSSION

The first step in the development of animation-based learning media is to ensure the feasibility and suitability of the media with learning needs. Therefore, the validation process was carried out by two experts, namely media experts and material experts. Validation by media experts includes indicators of graphic design, animation quality, ease of navigation, use of color, typography, as well as overall aesthetic aspects. The validation results showed that the media obtained a score of 92.5%, which is classified as "very feasible". This shows that the media has met the principles of effective and engaging instructional design. Meanwhile, validation by material experts focuses on the suitability of the content of the material with basic competencies, the accuracy of the concept, the order of presentation, the integration with the curriculum, and the relevance of the material to the context of daily life. The validation score from the subject matter expert was 89.7%, also in the "very feasible" category. This shows that animation is able to present the material scientifically and in-depth, but still in accordance with the characteristics of junior high school students. This finding is strengthened by the results of research from Wulandari and Marbun (2021), which affirm that well-structured, expert-validated, and curriculum-based learning media will be better prepared to be implemented in the classroom.

After the validation process, the media was tested on a limited basis on 30 grade VII students at one of the State Junior High Schools in NTB. The trial aims to find out students' responses to media and to measure its effectiveness in improving learning outcomes. The instruments used included user response questionnaires and learning outcome tests (pretest and posttest). The average pretest score obtained by students before using animation media was 62.3, which indicates that the initial understanding of the material is still relatively low. After students learn to use animation media, the average posttest score increases to 83.6. This increase shows an increase of 21.3 points, and if calculated using the Hake (1998) gain score formula, a gain of 0.56 is obtained, classified as a medium to high category. This indicates that

animation media has considerable effectiveness in increasing the mastery of the concept of changing the form of substance. These results support the findings of Yusuf and Rahmawati (2023) who stated that the use of animation media in science learning provides a concrete visual experience, which significantly affects students' understanding of abstract scientific concepts.

The student response questionnaire consists of 10 statements that include aspects of usability, ease of access, clarity of information, visual appeal, and benefits for understanding the material. The results of data processing showed that 91.3% of students responded positively to the media. They stated that the media is very interesting and makes it easier to understand concepts that were previously difficult to understand only with textbooks and oral explanations. Some of the students' comments showed that the animations shown helped them visualize scientific processes, such as the change of water vapor to dew (condensation) or the freezing process (freezing). This proves that animation as a dynamic visual medium is capable of transforming material that is invisible to the eye into something visually understandable. Herlina et al. (2022) found that animation-based media facilitates students' cognitive and affective learning in a balanced manner, increasing interest and information retention over a longer period of time.

One of the main advantages of animation-based media is its ability to convey abstract concepts in a more concrete and systematic manner. The concept of changing the form of substances such as melting, evaporating, sublimating, condensing, and freezing, is basically a microscopic process that cannot be directly observed by students. Animation media allows visualization of particles of matter in various energy and temperature conditions, so students can see how particles change as a substance changes shape. This visualization works based on the multimedia learning theory from Mayer (2020), which states that learning will be more meaningful when students receive information in the form of narrative text and integrated visual animations. The study also supports Mayer's argument that the combination of images and sounds will optimize two information processing channels in human working memory: visual and auditory channels.

The developed media also has an interactive quiz feature that students can use independently. This interactivity increases students' active participation in the learning process and triggers reflection on the material that has been delivered. Interactivity is an important component of meaningful learning because it engages students to think critically and make decisions. As stated by Astuti and Nuryanti (2022), the presence of interactive features in digital media can increase students' control over their learning process and develop metacognitive skills. In addition, the presence of narrative elements and short stories in animation provides real-life context relevant to the material, for example the evaporation process that occurs when drying clothes or the process of freezing water in a refrigerator. The interconnectedness between scientific concepts and everyday phenomena is essential to build a strong and meaningful construction of understanding for students. This is in line with the constructivist view that students' understanding is formed from the interaction between new information and previous knowledge (Widodo et al., 2021).

Although the media showed positive results, the study also noted some limitations. First, there are still students who need guidance in using software-based media, especially those who are not familiar with learning technology. Therefore, the role of teachers as facilitators remains important, both in providing direction for the use of media and in deepening discussions after the animation is aired. Second, this research was only conducted on one material and within the scope of a limited trial. Therefore, generalization of the findings still requires further research with a wider scope of material and samples. Research by Suryani et al. (2021) also suggests that the effectiveness of animation media needs to be tested in various classroom and cognitive level conditions to measure its impact more comprehensively.

However, the results of this study provide an idea that animation-based learning media can be a strong alternative in the science education process at the junior high school level. Its integration with the independent learning curriculum approach also allows for flexibility in the application and personalization of learning.

The results of the study show that animation-based learning media developed through the ADDIE model has proven to be very feasible and effective in science learning in grade VII. Validation from media and material experts provides high scores that demonstrate visual quality, interactivity, and content suitability with the curriculum. Trials with students showed a significant improvement in learning outcomes and a positive response to the use of animation media. This medium successfully presents abstract concepts in concrete terms through dynamic visualization and engaging audio narration, thus supporting deeper understanding and a more enjoyable learning experience.

Animation media also facilitates interactive and contextual learning, increasing student motivation, engagement, and retention of the material. Although there are several challenges in implementation, such as the need for technological support and teacher mentoring, these findings confirm that animation media is an innovative solution in answering the difficulties of abstract science learning. This study suggests that teachers start integrating animation-based digital media as part of active and creative learning strategies. Further development could include other science topics, gamification features, as well as integration with online learning to support a more adaptive and technology-driven transformation of 21st-century education.

CONCLUSION

The results of the study show that animation-based learning media developed through the ADDIE model has proven to be very feasible and effective in science learning in grade VII. Validation from media and material experts provides high scores that demonstrate visual quality, interactivity, and content suitability with the curriculum. Trials with students showed a significant improvement in learning outcomes and a positive response to the use of animation media. This medium successfully presents abstract concepts in concrete terms through dynamic visualization and engaging audio narration, thus supporting deeper understanding and a more enjoyable learning experience.
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