EFFECTIVENESS OF STE-PBL MODEL ASSISTED BY WORDWALL MEDIA TO IMPROVE STUDENTS' LEARNING OUTCOMES

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Abstract

This research aims to determine (1) determine the effectiveness of the STEM PBL model assisted by WordWall media to improve student learning outcomes on solar system material (2) determine student responses to the application of STEM PBL assisted by wordwall media on solar system material. Data collection techniques This research uses tests and non-tests, for tests using multiple choice tests. This test will be given to both research classes (control and experiment) to measure student learning outcomes. Tests are carried out before learning (pre test) and after (post test). Meanwhile, non-tests include learning modules, LKPD, expert validation, learning result documents and student response questionnaires to learning. The approach used in the research is quantitative, a quantitative approach with random sampling techniques and quantitative instruments (using mathematics to test the hypothesis). The results of this research can be concluded that (1)The STEM-PBL model assisted by wordwall media to improve student learning outcomes on solar system material in the successful category (2) Knowing the students' responses to the application of STEM PBL assisted by wordwall media in the experimental class and control class. The highest achievement was obtained in the experimental class with the very good category and the lowest achievement was obtained by the experimental class with the good category.

[Keywords: STEM, Problem Based Learning, wordwall, learning outcomes, interactive learning media

1 INTRODUCTION [ARIAL, 12-POINT, BOLD, UPPER CASE AND LEFT ALIG.]

Education is the foundation that supports the development and progress of a society. Education is not only the process of transferring knowledge from generation to generation, but also the key to forming character, skills, and values that are essential for individual and collective success. Education provides a means to unlock human potential, develop a deep understanding of the world around them, and facilitate critical and creative thinking skills. In the era of globalization and technology that continues to develop. An inclusive and results-oriented educational approach ensures that every individual has equal access to develop themselves, regardless of background or economic conditions. By instilling moral values, ethics and social responsibility, therefore, investing in education is not only about an individual's future, but also a strategic investment in the social and economic progress of a nation. Therefore, education management must be focused on efforts to create better improvements.(Supriyadi et al., 2022).

The law regarding the national education system was enacted in 2003, namely Law Number 20(Moghtaderi et al., 2020)Providing a mandate for National Education which aims to increase the intelligence of the nation's life and advance Indonesian society as a whole. All of this includes individuals who have faith and piety in God Almighty, have high morality, broad knowledge and skills, and have good physical and mental health, a strong and independent personality, and have high social awareness.(Riri Nurandriani & Sobar Alghazal, 2022).

Learning Natural Sciences (Science) is a crucial aspect in the educational context because it involves understanding and exploring natural phenomena and the surrounding environment. Science learning does not only act as a means of transferring information, but also as a vehicle for developing critical thinking, inquiry and analysis skills for students. By understanding basic scientific principles, students can improve their ability to think logically and apply these concepts in everyday life. Quality science learning also stimulates students' creativity and curiosity, helping them understand the relationship between scientific theory and practical reality. Thus, science learning is not only about the transfer of knowledge, but is also an effort to form scientific thinking, ethics and a deeper understanding of the ever-changing world as stated by(Fikrie, 2021).

STEM is an approach that involves 4 subjects, namely science, technology, engineering and mathematics. The STEM approach encourages active involvement of students in projects that are

relevant to their daily lives(Said, 2023). By involving students in this challenge, they become more enthusiastic about learning and understand STEM concepts better. STEM learning materials are often considered a challenge because of their difficulty. In the 1990s, the term STEM was introduced by the United States National Science Foundation (NSF) as an abbreviation for Science, Mathematics, Engineering, and Technology. Science includes natural principles and proven facts, technology provides access to data and meets needs, engineering applies that technology, while mathematics is used to understand and solve everyday life problems. STEM learning is a learning approach that integrates various scientific disciplines using an inter-science approach, the application of which is carried out through active learning based on problem solving.(Hamid et al., 2022).

STEM-based learning has become the main focus in preparing the young generation to face the challenges of the modern world in the future. One way of learning that can increase the effectiveness of STEM learning is by using a problem-solving-based learning (PBL) model. Through PBL,Students can learn STEM knowledge and skills contextually through real-world problem solving.(Nida'ul Khairiyah, 2019). In this context, students not only understand scientific, technological, engineering and mathematical concepts but also learn to apply them to solve concrete challenges and problems. Through PBL, students are actively involved in the learning process, work together, and develop critical and creative thinking skills.This combination of STEM and PBL can produce an interesting and relevant learning environment, preparing students to become competent and innovative problem solvers in a society that continues to advance technologically.Each approach definitely has advantages and disadvantages, and this also applies to Problem Based Learning which is described as follows:(Zainal, 2022): Problem Based Learning (PBL) has a focus on students, improving problem solving and scientific thinking skills, combining theory and practice, and encouraging social involvement and communication. However, there are shortcomings, such as teachers' difficulty in changing teaching styles, the time required for students to solve problems, and challenges in contextual learning assessment. Nevertheless, PBL remains a learning approach that has the potential to provide deep learning experiences.

To improve the quality of learning, it is necessary to combine STEM and PBL. Through PBL, students are faced with the challenges of solving real world problems. STEM not only improves their critical thinking skills, but also provides a deeper understanding of the relationships between scientific fields.(Rohmah et al., 2021).Learner engagement is enhanced by the change because they are involved in activities that are directly related to everyday life. STEM-PBL allows students to connect abstract concepts in science, technology, engineering, and mathematics to real situations.Thus, students can see firsthand the relevance and application of their learning, which may increase interest and motivation to learn.(Rohmah et al., 2021). Participation in STEM PBL projects often requires teamwork, collaboration, and communication among learners, providing them with opportunities to hone social and cooperative skills in completing complex tasks. This can significantly improve students' learning experience. To overcome learning difficulties, students need to use the right media so that their understanding of science concepts increases and their learning outcomes increase. This is because learning media not only increases the efficiency of the teaching and learning process, but also helps students absorb learning material more deeply and thoroughly(Sartika et al., 2023). Media is a learning environment that really supports the achievement of optimization in learning, media is a learning bridge that initially contains concrete objects such as children's experiences, accompanied by key words and concepts. One way to overcome low student learning outcomes is to use Wordwall Media.

Wordwall is a free learning tool that can be customized to enhance group and individual learning, engaging students more actively during the learning process. Wordwall helps students understand material without depending on the teacher (Turohmah et al., 2020) and can be used to monitor students' abilities, improve learning outcomes. With this, teachers can design PBL challenges using Wordwall media to present key information or build quizzes related to problems faced by students. Wordwall media, as a learning medium, provides various interactive tools, word games and quizzes that make the learning process more interesting.(Herta et al., 2023). Learners tend to respond positively to these elements because they provide variety in teaching methods and provide a more interactive learning experience.

The use of Wordwalls in STEM learning provides significant benefits to students by improving their critical thinking skills in the learning process.(R. Septianingsih, D. Safitri, 2023). Wordwall not only adds an element of fun through word games and interactive activities, but also enriches students' understanding of key concepts in STEM. By visualizing vocabulary and definitions, Wordwall helps learners remember information better. Apart from that, the existence of a Wordwall provides an opportunity for students to group together and communicate effectively in the context of a PBL project.

Through word games or challenges presented, Wordwall can stimulate students' problem solving and creative thinking, integrating learning in an interesting and meaningful way as a formative evaluation tool. Wordwall provides instant feedback on learner understanding, giving teachers the insight necessary for instructional adjustments and improvements. With its flexibility and ability to adapt to any learning context, Wordwall is a valuable addition to support the integration of STEM and PBL, creating a holistic and relevant learning experience for learners.

Research on the application of STEM PBL assisted by Wordwall is needed to introduce innovative approaches in improving student learning outcomes. The integration of real-world projects in STEM PBL provides contextual learning experiences, while Wordwall adds an interactive dimension that spurs student engagement. The urgency of this research does not only lie in improving learning outcomes, but also in transforming learning approaches towards creativity, critical thinking, and students' readiness to face the challenges of the 21st century.(Salim, 2023). Through a combination of real-world projects and Wordwall interactivity, it is hoped that this research can create learning experiences that are interesting, relevant, and make a positive contribution to student development. Based on the description or problem presented, it is necessary to implement STEM problem based learning assisted by Wordwall media to improve student learning outcomes.

METHODOLOGY

The approach used in the research is quantitative which examines the application of STEM_PBL assisted by Wordwall media to improve student learning outcomes in class VII Tegal City Middle School for the 2023/2024 academic year. Quantitative approach with random sampling techniques and quantitative instruments (using mathematics to test the hypothesis).(Susongko, 2017).

This research utilizes experimental methods involving a pretest-posttest group/control group design. The aim is to assess whether the application of the problem-based learning model with a STEM approach assisted by wordwall media can improve student learning achievement at the junior high school level.(Sukmawati & Mulyono, 2023).

This research uses an experimental method with a pretest-posttest group/control group design. The essence of the research carried out is the influence test, the data of which is obtained from the pretest and posttest carried out by the students(Nurhutami, 2019). The research was conducted with two classes, where one was a treatment class (experimental class) and the other was non-treatment (control class). The effect given is the application of the problem based learning model by utilizing media in the form of a wordwall. Different from the treatment class, the non-treatment class does not use wordwall media in implementing their learning. The data obtained as a result of the pretest and posttest were then compared. The research design is attached in Table 3.1

Table 3.1 *Research design*

Group	Pretest	Treatment	Posttest
Experiment	Yb	X1	Yes
Control	Yb	X2	Yes

Information :

Yb = Dependent variable carried out before the experiment (pretest)

Yes = Dependent variable carried out after the experiment (posttest)

X1 = STEM-PBL learning with the help of wordwall media

X2 = STEM-PBL learning without the help of wordwall media

In this research, there are two types of variables: independent variables and dependent variables.

1. Independent Variable (Independent):

Independent variables are factors that influence other variables. In the context of this research, the independent variable is the application of the STEM-PBL learning method with and without the help of Wordwall media.(Ulfa, 2021).

2. Dependent Variable:

The dependent variable is a factor that is influenced by the independent variable. Student learning outcomes are the dependent variable in this research.(Ulfa, 2021). The population of the study included 256 students in the district of class VII in one of the State Middle Schools in Tegal City, divided into 8 classes with an average number of students per class of 32 students. The sample is a component of the population from which data is taken. Because collecting data from a selected population takes longer, researching only a small portion of the population is a solution. This research will utilize purposive sampling technique. Selected individuals are considered to represent a larger population and then data is collected from that group(Lenaini, 2021). Sampling was recommended by a science teacher at a public junior high school in one of the cities of Tegal. From the sampling, there are two classes that will be used in the research, namely class VII F and VII D.

RESULTS

This study shows that the use of the STEM-PBL model with Wordwall media support significantly improves student learning outcomes. In the effectiveness test, the experimental class using this approach obtained an average percentage value of 87%, which is included in the “Successful” category. In contrast, the control class that used conventional learning methods only achieved an average score of 65%, which was categorized as “Unsuccessful”.

According to research by Yolanda & Reinita (2019), learning is said to be successful if at least 75% of students in the class successfully achieve the Minimum Completion Criteria (KKM). In this case, the experimental class managed to reach the 75% KKM, indicating that the application of STEM-PBL assisted by Wordwall is very effective in improving learning outcomes.

The STEM-PBL model allows students to engage in real problem solving, which naturally improves their analytical and critical thinking skills (Anggraini et al., 2022). With the use of Wordwall media, the material is presented in an interesting way, which encourages students to be more enthusiastic in learning. This is in line with the research of Durrotunnisa & Nur (2020) which states that the use of Wordwall media has a positive impact on student learning outcomes. Students' enthusiasm for learning is also an important factor in the success of this model. The use of Wordwall as learning media has increased students' motivation, which can be seen from their positive responses during the learning process. The LKPD used in the experimental class was more interesting and easily understood by students, especially in class VII D. This shows that Wordwall not only improves students' understanding of the material, but also facilitates the learning process itself.

This finding is in accordance with the research of Suratman et al. (2019) which states that successful learning is when students are able to absorb the material well, both individually and in groups. The use of interactive media such as Wordwall helps students to be more focused and actively involved in learning.

Analysis of Learning Achievement

The highest achievement in this study was in the knowledge/recall aspect with a percentage of 95%, which is included in the very good category. The lowest achievement was in the analysis aspect with a percentage of 71%, which is still classified as good. This indicates that students have successfully understood and remembered the basic concepts taught, as well as being able to apply their knowledge to solve problems although there is still room for improvement in the analysis aspect.

Knowledge/Remembering: Students are able to recall important elements such as basic terms, facts, and methods, which become the foundation for further learning.

Comprehension: Students are able to translate learned information into different contexts and understand the meaning of different sources of information.

Application: Students are able to use knowledge to solve real problems in practical situations.

Analysis: Students are able to separate information into smaller parts and understand the relationships between parts.

Synthesis: Students are able to organize separate elements into a coherent and meaningful whole.

Evaluation: Students are able to assess information or work based on predetermined criteria.

Constraints and Recommendations

Despite the positive results, the implementation of STEM-PBL is not free from obstacles. Some of the obstacles faced include limited facilities and resources at school, as well as teacher readiness in implementing this method. The STEM-PBL approach requires more time compared to conventional methods, so more flexible curriculum adjustments are needed.

As a recommendation, the use of Wordwall media can be used as a solution to overcome most of these obstacles. Wordwall helps to simplify the delivery of materials and facilitate the implementation of projects in STEM-PBL. In addition, training and professional development for teachers is essential to improve their competence in implementing this method effectively.

CONCLUSIONS

From the research results it can be concluded:

The STEM-PBL model assisted by wordwall media is effective in improving student learning outcomes. This can be seen from the results of the classical completeness test in which it is explained that the success of competency construction is seen from classical completeness, which requires a minimum of 75% of the samples involved to be considered complete (more than or equal to KKM) with the results of the hypothesis test sig value. (2- tailed) = 0.535>0.05 so that H0 is rejected and Ha is accepted.

Students' response to STEM-PBL to improve students' learning outcomes through the use of wordwall media is said to be effective. the highest achievement is in the second aspect, namely knowledge / memory with a percentage of 95% with a very good category. While the lowest achievement is in the analysis with a percentage of 71% with a good category.

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