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Application of Wordwall Media in PPKn Learning for Grade IV Elementary School Students

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Abstract

Background - PPKn learning has an important role in shaping students' character, but conventional methods often make them passive and less motivated. Therefore, learning innovation is needed by utilizing interactive digital media so that students are more active and understand the material better.
Purpose - This study aims to describe the application of wordwall media in learning Pancasila and Citizenship Education (PPKn) in grade IV of SD Muhammadiyah Plus Malangjiwan Colomadu. Wordwall is a digital-based learning media that allows teachers to create interactive activities such as quizzes, matching, and other educational games to increase student engagement and understanding of the subject matter.
Method/approach - This study uses a descriptive qualitative method with data collection techniques including interviews, observations, and documentation. To ensure the validity of the data, triangulation of techniques and sources is used. Meanwhile, data analysis is carried out through three main stages, namely data presentation, data reduction, and verification or drawing conclusions.
Findings - The results of the study show that in learning planning, teachers rarely create teaching modules or RPPs so that they only compile them when there are administrative needs. The use of wordwall in PPKn learning has a significant impact on student engagement, where students become more active in discussions, show increased enthusiasm in answering questions, and understand the concepts taught more easily. Compared to the lecture method, student engagement increased substantially, with most students showing active participation during the learning process. Supporting factors in the implementation of this media include adequate internet access and the availability of devices such as projectors and speakers.
Conclusions - However, there are several obstacles such as limited time for teachers to create media, minimal teacher skills in using technology, and technical obstacles such as unstable electricity. As a solution, training and assistance are needed for teachers in utilizing digital-based media in order to optimize learning, as well as arranging the schedule for using projectors or increasing the capacity of electricity to overcome technical obstacles.
Novelty/Originality/Value - The implication of this study is that the integration of digital media such as wordwall in PPKn learning not only increases student engagement but also encourages innovation in teaching methods, so teachers need to develop their digital competencies to create more engaging and effective learning.

Keywords: educational technology; citizenship education learning; wordwall media

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INTRODUCTION

Quality education is a fundamental pillar in building superior, competitive human resources that contribute to the progress and welfare of a nation. A well-designed, research-based education system that is in line with the needs of the times is the main key in realizing optimal education quality (Rahman et al., 2022). Education design should include a relevant curriculum, adaptive learning materials, and innovative and effective teaching methods (Kemendikbud, 2022). In addition, education must continue to be oriented towards change and continuous improvement to ensure quality improvement in accordance with global challenges and the needs of society.

The quality of a nation's education is supported by its human resources. When compared to other countries, Indonesia still has low quality human resources. The quality of Indonesia's human resources is ranked 53rd out of 130 countries according to the World Economic Forum (WEF) in 2023, much lower than other ASEAN countries such as Singapore (3^{rd}), Malaysia (22^{nd}), and Thailand (44^{th}). Education can provide quality human resources by helping students realize their full potential (Mariyani & Andarusni, 2021).

Therefore, the quality of education is very supportive in developing students' potential. In developing student potential, Mathematics plays an important role by encouraging mastery of various academic skills and talents (Aprilia & Supriadi, 2021). This subject must be studied at every level of education because it has a crucial role in various disciplines (Wulandari, 2021). Apart from being part of the curriculum, mathematics also has broad applications in everyday life. As an exact science, mathematics does not only rely on memorization but focuses more on logical and creative thinking (Ayu et al., 2021). Through learning mathematics, students can hone critical thinking, reasoning, and cognitive skills that support systematic problem solving.

Mathematics learning as one of the sciences is believed to be able to form students who have mathematical creative thinking skills (Purnamasari, 2021). Based on the Decree of the Standards, Curriculum, Assessment and Education Agency (BSKAP) Number 33 of 2022, the purpose of learning mathematics is to improve students' abilities, one of which is creative thinking. Mathematical creative thinking ability is one of the main skills that students need to have to solve problems (Utami et al., 2020). By developing this skill, students are required to solve problems from several perspectives, integrate information in new ways, and participate in solving mathematical problems (Aminah et al., 2022). Thus, mathematics learning should prioritize improving students' mathematical creative thinking skills.

Mathematical creative thinking skills are of utmost importance, yet Indonesian students still struggle in this area. Evidence of their low ability to solve mathematical problems is evident in the findings of the PISA 2022 results (OECD, 2023). Indonesia's math performance was below the global average, scoring 379 and ranking 68th. According to Kartika & Efriani (2022) to be successful in solving PISA problems, students are required to be able to express and develop creative (unique) and original problem solutions. The PISA test shows a strong indication that creative thinking skills play an important role in student performance. Thus, the achievement of low PISA assessment scores means that students' mathematical creative thinking skills are low.

Low mathematical creative thinking skills also occur in class VIII students at Junior High School (SMP Negeri 1 Bandar Lampung). This is indicated by the results of students' answers in solving the test questions of mathematical creative thinking ability, namely obtained in question items number 1- and 2-point a, there are 12% (3 out of 25) students answered the question correctly while the remaining 88% (22 out of 25) students could not answer the question correctly. Most students to interpret the meaning of the question is not fully good and needs to be optimized. This is based on students' inability to translate the question information into the form of a mathematical model. Students also expressed answers inaccurately and gave irrelevant ideas in solving problems. In addition, based on the results of observations and interviews with mathematics teachers obtained that the teacher said that when given a problem that leads to students' mathematical creative thinking ability, most students experience incomprehension in responding to statements, lack of varied ideas and lack of detailing the problem in detail. Students also often experience problems when they have to connect the knowledge and experience, they have with new knowledge.

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Based on the results of observations and experiences following learning in class VIII with the mathematics teacher at SMP Negeri 1 Bandar Lampung, it was found that the learning carried out by the teacher was mostly conventional learning, namely with a scientific approach but the implementation of the independent curriculum in learning was not optimal. According to Ta'i et all (2023) conventional learning occurs when students only acquire passive knowledge from their teachers and are usually teacher cantered. Teachers still use learning methods such as presenting material, showing example problems, giving homework, asking students to solve exercise problems from the source book, and then holding class discussions about the answers. As a result, students' ability to generate ideas is not developed optimally.

In dealing with these problems, it is important to promote innovation in learning that can improve creative thinking skills is a learning model that relates to real experiences that require the application of their knowledge, skills and understanding to solve problems. One of the learning models that can encourage students to explore their thinking abilities and trigger their curiosity is the problem-based learning (PBL) model. This learning model orientates students to learn to grow individual experiences and group experiences in themselves through group discussions, so that they are able to determine, develop creativity from some information as a solution to a problem (Cahyaningsih & Ghufron, 2024). By providing problems using the PBL model, students can express their ideas freely, so that the active role of students in mathematics learning can stand out. According to Damira & Alberida (2022) the PBL model provides an opportunity for students to identify various ways that are considered appropriate to the ability to collaborate on mathematical problems.

Based on the explanation above, the purpose of this study is to determine the effect of PBL model on students' mathematical creative thinking ability. In this study, the PBL model has an influence if the increase in mathematical creative thinking of students who follow the model is higher than that of students who follow conventional learning.

METHODS

Sampling in this study used purposive sampling technique, namely sampling with certain. Sampling was done by selecting two classes taught by the same teacher with the consideration that before conducting the research the two classes received relatively the same treatment. After two classes were selected as research samples, then randomly selected experimental and control classes. Based on the sampling technique, two classes were selected, namely class VIII-10 as an experimental class that received learning using the PBL model and VIII-11 as a control class that received learning using conventional learning. The design used in this research is pretest-post-test control group design. The pretest was conducted before treatment to obtain initial data on students' mathematical creative thinking ability, while the post-test was conducted after treatment to obtain final data on students' mathematical creative thinking ability.

The data collected in this study are quantitative data in the form of initial data on students' mathematical creative thinking skills obtained from pretest scores, final data on students' mathematical creative thinking skills obtained from post-test scores. These data were collected through test techniques. Tests were used to collect data on mathematical creative thinking skills given to experimental and control classes.

The instrument used in this research is a test instrument in the form of description questions. Pretest and post-test were carried out using the same instrument. The test instrument in this study used three description questions on the material of the system of linear equations of two variables in class VIII Junior High School. The research in the experimental class was carried out with 8 sessions, giving a pretest at the first meeting followed by giving student worksheets at the second to seventh meetings then at the last meeting a post-test was given.

In this study, the test instrument has gone through validity, reliability, differentiating power, and difficulty level tests. The validity test results with mathematics teachers at SMP Negeri 1 Bandar Lampung showed that the test questions were declared valid. Then, the test instrument was tested outside the research sample. After calculating the reliability test, the reliability coefficient value was 0.90 so the test questions were declared reliable. The test of the differentiating power of the test questions obtained results of 0.39 to 0.63 which indicates that the questions have good differentiating power. The test results of the difficulty level of the test questions obtained a difficulty index of 0.48 to 0.62 which indicates that the test questions are included in the moderate category. Based on the test results that have been carried out, it can be concluded that the test instrument is suitable for use in research.

The initial steps in testing the hypothesis include analyzing the data collected from the pretest and posttest to determine the gain score. Furthermore, the prerequisite test was carried out, namely the normality test. The normality test carried out with the Lilliefors test gave the result that the data on the gain (increase) of students' mathematical creative thinking ability in the experimental class came from a population that was not normally distributed while the control class came from a normally distributed population. In the experimental class $L_{count} = 0.19 > L_{table} = 0.15$, and in the control class $L_{count} = 0.12 < L_{table} = 0.15$.

RESULTS AND DISCUSSION

Gain data is obtained from pretest and posttest results. The data is used to determine the improvement of students' creative mathematical thinking skills in experimental and control classes. The results of the calculation of data gain (improvement) of students' mathematical creative thinking skills are presented in Table 1.

Table 1. Gain Data of Students' Mathematical Creative Thinking Ability

Class	Number of Students	Lowest Gain	Highest Gain	Average	Standard Deviation
Experiment	32	0,43	1,00	0,75	0,13
Control	31	0,07	0,87	0,59	0,22

The data presented in Table 1 shows that the experimental class shows a greater average gain (improvement) in students' mathematical creative thinking skills than the control class. The standard deviation of the control class is higher than the experimental class. This shows that the increase in students' mathematical creative thinking ability in the control class is more diverse than the experimental class students. The lowest and highest gain scores in the experimental class exceeded the gain scores in the control class. In the prerequisite test, the results of the gain data of mathematical creative thinking ability in the experimental class came from a population that was not normally distributed while the control class came from a normally distributed population, so the hypothesis test was carried out using the Man Whitney U test. The results of the hypothesis test are presented in Table 2.

Table 2. Hypothesis Test Results

Class	Number of Students	$\lvert Z_{count} \rvert$	$Z_{table} = Z_{(0,5-\alpha)}$	α	Conclusion
Experiment	32	2,52	1,65	0,05	H_0 ditolak
Control	31				

Based on Table 2, it can be seen that $Z_{count} > Z_{table}$ then H_0 is rejected. Thus, the median gain data of mathematical creative thinking ability of students who follow PBL model is higher than the median gain data of mathematical creative thinking ability of students who follow conventional learning. This shows that the increase in students' mathematical creative thinking ability in the class that followed the PBL model is higher than the mathematical creative thinking ability of students who followed conventional learning.

Then, to assess the achievement of indicators of students' mathematical creative thinking ability in both classes, an indicator analysis of students' initial and final scores was carried out.

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The achievement of students' mathematical creative thinking ability indicators both before and after learning activities with PBL models and conventional learning are presented in Table 3.

Table 3. Achievement of Student Mathematical Creative Thinking Ability Indicators

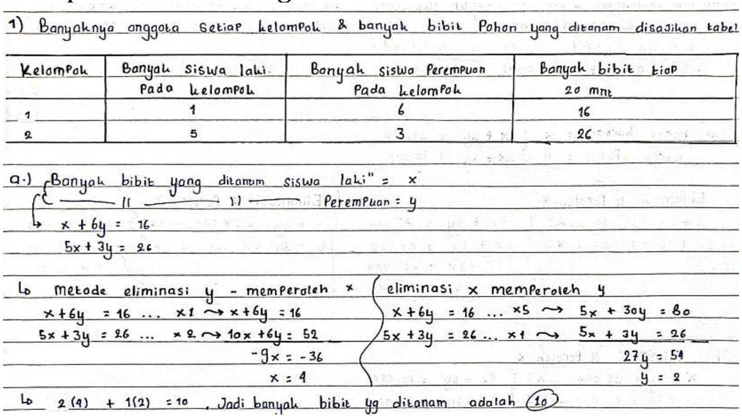
Indicator	Experiment Class		Control Class	
	Initial	End	Initial	End
Sensitivity	68,22%	100%	74,73%	99,46%
Fluency	20,18%	84,37%	18,68%	73,65%
Elaboration	16,85%	79,24%	16,70%	65,43%
Flexibility	13,28%	74,47%	13,44%	61,29%
Originality	12,89%	71,28%	15,92%	57,45%

The data presented in Table 3 shows that there is no significant difference in the initial ability of students' mathematical creative thinking in the experimental and control classes. This shows that both classes have the same initial ability in mathematical creative thinking ability. However, after receiving different treatments, the experimental class showed a greater increase in indicators than the control class.

The highest increase in the achievement of indicators in the experimental and control classes was the fluency indicator. The increase was 64.19% in the experimental class and 54.97% in the control class. The increase was influenced by the application of learning that was carried out. In the experimental class, students who took part in learning with the PBL model were accustomed to being given open problems as well as real problems. Students are accustomed to working on non-routine problems so that when given creative thinking problems, students can solve them correctly. According to Pelu (2019), the PBL model is interactive learning that starts from a real context problem that can encourage students to answer problems with various strategies so that students are able to consider the success of the answer appropriately.

The lowest increase in the achievement of mathematical creative thinking ability indicators among experimental and control classes occurred in the sensitivity indicator, with an increase of 31.78% in the experimental class and 24.73% in the control class. The low increase was due to the high initial ability of students in understanding the problems presented, both in the experimental and control classes. In the experimental class, this happened because students who participated in learning with the PBL model were accustomed to analysing and understanding mathematical problems before answering. When given a problem that requires creative thinking, students tend to write down the known information completely first. According to Ningrum and Farhan (2023), students need to connect the mathematical concepts they already have with the problems they face. Through the PBL model, students have the opportunity to find new solutions in problem solving, especially those related to mathematics.

The following is an example of the answers of students who have high mathematical creative thinking skills are presented in image 1.


1) Banyaknya anggota setiap kelompok & banyak bibit pohon yang ditanam disajikan tabel

Kelompok	Banyak siswa laki pada kelompok	Banyak siswa perempuan pada kelompok	Banyak bibit tiap 20 mnt
1	1	6	16
2	5	3	26

a.) Banyak bibit yang ditanam siswa laki" = x
— " — " — perempuan = y
x + 6y = 16
5x + 3y = 26

metode eliminasi y - memperoleh x
x + 6y = 16 ... x1 → x + 6y = 16
5x + 3y = 26 ... x2 → 10x + 6y = 52
-9x = -36
x = 4

eliminasi x memperoleh y
x + 6y = 16 ... x5 → 5x + 30y = 80
5x + 3y = 26 ... x1 → 5x + 3y = 26
27y = 54
y = 2

2(4) + 1(2) = 10, Jadi banyak bibit yg ditanam adalah 10

Figure 1. Example of Student Answer

The student's answer shows that the student's mathematical creative thinking ability is high because the aspects of sensitivity, fluency, flexibility and originality in the answer are worth 4 each. The PBL model has several stages in learning, each of which can improve students' mathematical creative thinking skills. The first stage is orienting students to the problem. At this stage, each group is given an LKPD containing contextual problems that cause curiosity and desire to investigate and solve the problem. Through the problems presented through LKPD, each group identifies known information and understands the problems that must be solved. Students understand the problem by looking at each sentence in the problem given and writing down all the information obtained.

At the first meeting, each group was still equally confused in understanding the problem because they were not used to sorting out information, so the researcher needed to provide stimulus in the form of examples of depiction and triggering questions by the researcher so that students would not make mistakes in determining the plan. For the next meeting, each group was getting used to writing what was known and asked from a problem. Students are able to modify information using their own language that is easier for them to understand. This is in line with the opinion Pradana et al (2022); and Utami et al (2021) that students' sensitivity in creative thinking can be seen when understanding a problem and translating it into a mathematical model. Through the PBL model, students can find something new in solving a problem in a real-world context. This shows that learning with the PBL model can improve students' abilities in sensitivity.

The second stage is organizing students to learn. At this stage, each group must be able to create a mathematical model and then determine the appropriate methods to solve the problem. Each group seemed enthusiastic to discuss to determine alternative solutions that might be done and determine the right concepts and methods to be applied in solving the problem. By discussing with friends can increase cognitive engagement and make students active in expressing ideas, so that by discussing it is expected that students can help each other in understanding problems and solving problems (Lachner et al., 2021). According to NCTM (Larasati & Yuniata, 2021) also stated that discussion can also help students to determine methods of solving and develop procedures or strategies so that they can determine the right concept or method in solving problems. From the first meeting to the following meetings, each group was proficient in determining the plan. This shows that learning with the PBL model is able to improve students' abilities in aspects of sensitivity, flexibility, fluency and originality.

The third stage is guiding students in planning and conducting investigations. At this stage students collect all the information they have obtained and conduct investigations according to the guidelines in the LKPD. Students are very excited in conducting investigations even though sometimes they are still mistaken in following the stages in the LKPD but students keep trying. By doing this investigation, students' ability to describe the illustration of the problem given is getting better. As said by Sari et al (2024) that by using the PBL model, students are active in the process of information discovery or investigation so that students can foster ideas, diverse thinking and novelty. In line with the opinion of Wardono and Priangga (2021) which states that in problem-based learning students are actively involved in the process of exploration and information search, which allows them to develop various ideas, creative thinking, and innovative ideas. Thus, the third stage of learning with the PBL model is able to improve students' abilities in the aspects of flexibility, fluency and originality.

The fourth stage is conditioning students to develop and present work. At this stage, each group was directed to finalize the results of their problem solving in detail and prepare themselves to present their work. During the presentation activities, other groups were active in responding to the work of the group that presented the results, all groups dared to respond when there were differences in the solution steps used. This shows that students understand the solution steps they are working on so that they have the confidence to respond to the work of other groups where there are differences. This is in accordance with the opinion of Adillah and Hariyanti (2023) which states that by students presenting the results of their answers makes them understand the solution steps used. This is also in line with the opinion of Damira and Alberida (2022) which states that problem-based learning in presenting results, students are able to explain the details of an object and the ideas generated can be broadly described. Thus, the fourth stage in the class with the PBL learning model is able to improve the ability of elaboration.

The fifth stage is analyzing and evaluating the problem-solving process. After all groups have completed the problem-solving steps, then the researcher directs each group to divide the group into 2 teams, each team re-works the problem solving they use. If both teams get the same results, it can be concluded that the solution steps they use are correct, after that each group is directed to make conclusions according to the results obtained. Through this stage, students' mathematical creative thinking skills on the indicator of checking back are increased, because this stage makes each group member participate in the activity of checking the results of problem solving. By reworking in a smaller team can make students become more familiar with the problem-solving steps they apply and later be able to solve problems independently. This is supported by the opinion of Manurung & Marini (2023); Cahyaningsih & Ghufron (2024) which states that at the stage of evaluating the problem solving process students analyze and conclude their ideas and findings with other students resulting in students being able to translate information and then generate diverse ideas and detail a problem and can use their ideas that are different from their friends. The fifth stage of the PBL model improves students' abilities in all aspects of creative thinking skills, namely sensitivity, flexibility, fluency, elaboration and originality. Based on this explanation, students' mathematical creative thinking skills when learning mathematics can be improved by using the PBL learning model.

CONCLUSION

Based on the results of research and discussion, the Problem Based Learning (PBL) model is proven to have an effect on the mathematical creative thinking ability of students in class VIII of SMP Negeri 1 Bandar Lampung in the odd semester of the 2024/2025 academic year. The increase in mathematical creative thinking skills of students who take part in learning with the PBL model is higher than students who learn using conventional methods. However, this study has limitations, namely that it was only conducted for one month with a sample limited to one school, so the generalization of these findings is still limited. As a practical recommendation, training is needed for teachers in designing contextual problems that match the characteristics of students so that the implementation of PBL is more optimal. In addition, further research is recommended to use a mixed method design in order to provide a deeper understanding of the effectiveness of PBL, not only from a quantitative perspective but also through the exploration of qualitative factors that influence students' mathematical creativity.

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