



Creative Problem Solving Accompanied by Wordwall as an Assessment Media: Does it Have an Impact on Students' Higher Level Physics Thinking Abilities?

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Abstract: This study aims to examine the effect of the Creative problem-solving learning model accompanied by wordwall assessment media on the higher-order thinking Skills (HOTS) ability of physics class XI students of SMAN Balung. This research used an experimental method with a group pretest-posttest design. The data collection technique used was a written test. The tests given were objective pretest and posttest tests. The data obtained was tested using the Kolmogorov Smirnov statistical test data normality test so that the sig value was obtained. 2 tailed > 0.05 then the mann whitney-u test was carried out and obtained a sig value. (2-tailed) of 0.041. So the results of data analysis of students' physics HOTS ability are $0.001 < 0.05$. Based on the criteria used in decision-making in the Mann Whitney - u nonparametric statistical test, it can be concluded that H_0 is rejected and H_a is accepted, meaning that the average value of the experimental class is greater than the control class. so it can be concluded that the Creative problem-solving learning model assisted by wordwall assessment media has a significant effect on students' physics HOTS Skills ability.

INTRODUCTION

Living in the 21st century, creativity will be indispensable for humans to compete globally. There is no one who does not have creativity, but one's creativity needs to be honed and trained through education to create someone who competes with the creativity of each person (Craft, 2003; Cropley & Patston, 2019). The development of the times of education, especially in Indonesia, which has the aim of innovation for the better, with that in 2020 there is a new breakthrough to implement an independent curriculum, the application of an independent curriculum, educators involve students in learning activities to be creative, independent, free to innovate and think (Daga, 2021). As an educator, you can apply one of the learning models that can arouse students' creativity in solving physics problems, namely the Creative Problem Solving (CPS) learning model. Learning models that increase creativity will be a solution for learning in the modern era (Jantzen, 2016; Masek & Yamin, 2011). Various forms and types are used by science teachers to increase their students' creativity, which researchers believe is an indication of the importance of creativity in responding to future challenges (Sahito & Wassan, 2024; Sofna et al., 2023).

In today's learning, the CPS model is a learning model that researchers believe is able to provide additional enthusiasm and motivation for student learning, where students will experience greater interest in the learning theme being understood, which in this case is physics learning. Increased student motivation will mobilize all students' abilities in understanding and solving problems that arise in learning (Jannah et al., 2023; Mullet et al., 2018). Students will be encouraged to know more and carry out deeper analysis (enrichment) of the material being studied.

The creative problem solving learning model is a learning model that focuses on teaching and problem solving skills followed by strengthening creativity (Heinrich *et al.*, 2015; Sulman *et al.*, 2023). This model was developed by Alex Osborn and Sidney Parnes. CPS describes as a model of thinking skills that one of its functions is to improve the thinking process so that it is better able to overcome difficulties (Puccio et al., 2005). The CPS process includes steps: problem clarification, opinion expression, evaluation and selection and implementation. With this model, it is expected that when students are faced with a problem, they can perform problem-solving skills to select and develop their responses. This can be done not only by memorizing without thinking, but problem solving skills can also expand the thinking process (Meltzer, 2005; Walsh *et al.*, 2007).

The CPS learning model has the advantage of being able to solve problems faced realistically, conduct investigations to evaluate the results and advance the development of students' thinking quickly (Heinrich et al., 2015; Zandvakili et al., 2019). However, the weaknesses are such as some physics subjects are difficult to observe and conclude events due to limited laboratory equipment, and require a longer time allocation. From the shortcomings of the CPS learning model, learning is accompanied by media, and one of the media that can train students' ability to solve problems is wordwall assessment media.

Wordwall interactive media is a website-based media created by a European citizen that can be used to create learning media or become a learning resource, as one of the educational game platforms. Wordwall media has the advantage of being user friendly because it does not require a specific application by only accessing the website and the shared link, but besides that, wordwall media also has disadvantages such as cheating can occur because the quiz is assisted by surrounding people, but this can be overcome by giving a timer to the quiz (Imanulhaq & Pratowo, 2022). Research conducted that the use of wordwall learning media can foster student learning motivation and have an impact on student learning outcomes (Mujahidin et al., 2012).

Physics is one of the subjects that students are less interested in. Based on initial observations at one of the high schools, it was found that students were less active and had difficulty applying physics concepts that had been taught in the learning process, especially problem solving, the ability to remember students tended to be low, and the learning model applied did not support these problems. Physics learning that does not only require exposure to concepts and formulas, but will be more meaningful if it can be linked to everyday life, so that students know the benefits that will be obtained in learning physics concepts (Cummings et al., 2004; Walsh et al., 2007). Researchers use static fluid material to minimize the use of laboratory equipment. So that the creative problem solving learning

model is expected to be one of the learning models that can improve learning outcomes, especially in students' physics HOTS abilities and train students' science process skills.

METHOD

This study used a Quasi Experiment research model. The research was conducted with two classes, namely the experimental class and the control class (Neuman, 2014). The experimental class is a class that is given treatment using a creative problem solving learning model accompanied by wordwall assessment media on static fluid material while the control class uses the Teacher Center Learning model or lecture method, a method that is usually used by teachers. The pretest-posttest in this study was used to measure the initial ability of students' physics HOTS and the final ability of students' physics HOTS . The research design used in this study was a pretest - posttest only control group. Pretest - posttest only control group is a type of research design that compares the situation before being given treatment by researchers and the situation after being given treatment. The design that researchers used in this research can be seen in Table 1.

Table 1. Pretest - Posttest Only Control Group Design

Grouping	Pretest	Treatment	Posttest
Experimental	O ₁	X	O ₂
control	O ₃	-	O ₄

This research was conducted in November 2023 at SMA Negeri Balung. The population in this study were all 11th grade students of SMA Negeri Balung in the odd semester of the 2023/2024 school year as many as 216 students. The sampling technique was carried out by cluster randomized sampling, namely the sample was randomly selected because the population came from a homogeneous variance. Homogeneous means students have similar initial knowledge of physics. The selected samples were students of class XII and XI 3. As for determining the experimental class and control class using a random or random system. From the results of the random system obtained 36 students of class XII as an experimental class using creative problem solving learning model accompanied by wordwall assessment media and 36 students of class XI 3 as a control class using conventional learning model through lecture method accompanied by power point learning media. Data collection techniques were carried out through tests, which were carried out at the beginning and at the end of the lesson. Observations were made to find out student learning activities directly in the classroom assisted by observers.

The research data were analyzed for normality test with one way annova statistical test assisted by SPSS 26 application with the criteria if the sig value. <0.05 then the data is not normally distributed, but if the sig value. > 0.05 then the data is normally distributed. Furthermore, the statistical analysis of the difference between the 2 scores between the control class and the experimental class is carried out with the independent sample t test if the data is normally distributed, but if the data is not normal, the mann whitney - u statistical test is carried out. This research tries to provide an accurate and comprehensive picture of the learning strategies that researchers use properly and appropriately. This is a

consideration for researchers to look at and carry out tests as part of carrying out further actions in analyzing this research data.

RESULT AND DISCUSSION

Pretest And Posttest Results Of Students' Hots Skills

Data on students' High Order Thinking Skills ability was obtained using pretest and posttest in control class and experimental class. The pretest was conducted before learning and the posttest was conducted after learning. The control class used a conventional learning model with the lecture method and used the media commonly used by teachers, namely power point as learning media while the experimental class used a creative problem solving learning model with the help of wordwall assessment media as learning media. The data description of the pretest and posttest results of students' physics HOTS abilities can be seen in Table 2.

Table 2. Pretest and Posttest Result Data

Grouping	N	Mean	Std. Deviation	Minimum	Maximum
Pretest Experiment	35	55.1667	18.97743	.00	80.00
Posttest Experiment	35	68.2571	17.50016	.00	95.00
Pretest Control	36	47.1389	9.97755	26.00	76.00
Posttest Control	36	53.4722	10.47578	35.00	75.00

Based on Table 2, it can be seen that the pretest results in the experimental class obtained the highest score of 80 and the lowest score of 0 with the average value of the experimental class pretest results of 55.167. Meanwhile, the control class obtained the highest score of 76, and the lowest score of 26, so that the average value was 47.14. In the experimental class posttest results, the highest score was 95, the lowest score was 0 and the average value was 68.26. While in the control class the highest score was 75, the lowest score was 35, and the average value was 53.47. Data table 4.2 can be made a graph of the difference in students' Physics HOTS abilities between the experimental class and the control class as shown in Figure 1 below:

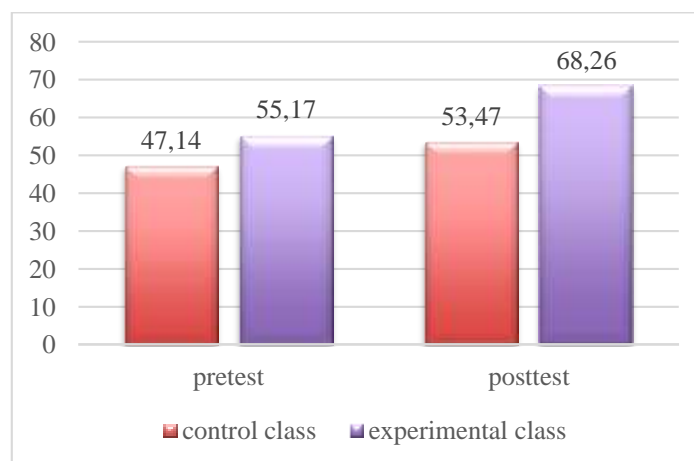


Figure 1. Student Physics HOTS Ability Scores

Figure 1 explains the value of students' physics HOTS ability through pretest and posttest in experimental and control classes. The experimental class obtained an average pretest of 55.17, while the control class amounted to 47.14. Furthermore, in the posttest, the experimental class obtained an average of 68.26 and the control class amounted to 53.47. Based on the average posttest score, the experimental class was higher than the control class. Analysis of the effect of wordwall assessment media on students' Physics HOTS abilities using pretest and posttest results. The data obtained was used for normality test and hypothesis testing using nonparametric test, namely Mann Whitenay U test.

Data on the results of students HOTS physics skills in terms of cognitive domain. The results obtained from the data in the form of pretests and posttests given to the control class and experimental class. The data obtained was then analyzed using the SPSS 26 application to test the research hypothesis. The normality test used is the Kolmogorov-Smirnov (K-S) test, the following are the results of the normality test of the data on the results of the HOTS ability of Physics Students.

Table 3. Normality Test Results of Student Physics HOTS Ability Data

Analysis Parameters		Pretest Experiment	Posttest Experiment	Pretest Control	Posttest Control
N		35	35	36	36
Normal Parameters ^{a,b}	Mean	55.1667	68.2571	47.1389	53.4722
	Std. Deviation	18.97743	17.50016	9.97755	10.47578
Most Extreme Differences	Absolute	.212	.167	.149	.170
	Positive	.149	.112	.129	.158
	Negative	-.212	-.167	-.149	-.170
Test Statistic		.212	.167	.149	.170
Asymp. Sig. (2-tailed)		.000 ^c	.014 ^c	.042 ^c	.010 ^c

Normality test decision making using the Kolmogorov-Smirnov (K-S) test, if $\text{sig} > 0.05$ then the data is normally distributed. However, if $\text{sig} \leq 0.05$ then the data is not normally distributed. Based on table 4.2 the value of Asymp. Sig. (2-tailed) on the experimental class pretest value is 0.000 which means $0.000 < 0.05$, for the experimental class posttest value is 0.014 which means $0.014 < 0.05$, and for the control class pretest value is 0.042 which means $0.042 < 0.05$, and the control class posttest value is 0.010 which means $0.010 < 0.05$. The data shows that the control class and experimental class are not normally distributed. So statistical testing cannot be done using the t-test statistical test but with the Mann-Whitney U non-parametric test. The data test that has been explained is a strong reference for researchers to determine further analysis to be taken, so that the data presented can represent and provide appropriate and comprehensive conclusions from the research that researchers are currently presenting. This analysis selection process is an important research step that cannot be ignored in making decisions in this research.

The analysis used in this research is the Mann – Whitney U test, where this analysis is used by researchers to determine whether the two sample data have differences in average or not. The first statistical hypothesis is, H_0 is the average score of the

experimental class is the same as the control class and H_a is the average score of the experimental class is higher than the control class. The following are the results of the Mann - Whitney U test from the data on the results of students' Physics HOTS abilities:

Table 4. Test Statistic Mann - Whitney U test

Analysis Parameters	Pretest Score	Posttest Score
Mann-Whitney U	350.000	222.500
Wilcoxon W	1016.000	888.500
Z	-3.241	-4.719
Asymp. Sig. (2-tailed)	.001	.000

Based on the output generated in table 4, it shows that the Sig. (2-tailed) of 0.001 for the pretest value and 0.000, which means that the value has a value smaller than the 0.05 significance level. Based on the basis of the Mann-Whitney U test decision making, it can be concluded that H_0 is rejected and H_a is accepted, meaning that the average score of the experimental class is greater than the control class. So it can be concluded that the CPS (Creative Problem Solving) learning model accompanied by Wordwall Assessment media has a significant effect on

HOTS Physics Ability of the Eleventh Grade Students'

The application of the stages Creative Problem Solving learning model starts from the exposure of problem clarification where the teacher provides a demonstration of the phenomenon of daily life problems related to static fluid, then students are asked to identify problems and formulate these problems. Furthermore, the disclosure of ideas, students are given LKPD which contains a discussion of unusual and uncertain problems, then students analyze and express opinions on the LKPD provided and proceed to present their opinions in front of the class, the next stage is evaluation and selection, the teacher guides students to evaluate the results of problem solving followed by the last stage, namely implementation, after the teacher evaluates students can change the results of problem solving according to the concept that has been justified by the teacher. From the problem clarification stage to implementation, this trains students to explain, decide, show, and produce problem solving in the context of knowledge and experience. So that with the application of the creative problem solving model stages, it trains students to start thinking at a high level. Many research views reveal that high-level thinking skills are able to link problem discovery and creativity through planning activities, self-observation of problem development, and adjusting problem-solving strategies and the ultimate goal is being able to solve problems accurately and well (Fernando et al., 2021; Lindsey K. Le, 2013).

Another factor that influenced the increase in posttest scores in the experimental class was the use of wordwall assessment media. As an additional learning media that can be applied at the evaluation learning model stage, with wordwall assessment media students are more active with the activities they do because the teacher's role is only as a facilitator. In addition, this assessment media gives students a higher curiosity because with classmates they compete to get the highest score and the name that has the highest score will be at the top on the leaderboard display. Several studies also provide information

that with the help of learning media, in this case the edugame wordwall learning media, can improve students' critical thinking abilities as seen from the difference in the average scores in cycle I and cycle II, which shows that there are differences. in scores and improvements after implementing learning with wordwall media. Then supported by Nadia et al (2022) research which states that the use of wordwall learning media is superior when compared to learning without media and conventional learning. Good and appropriate media can provide encouragement or enthusiasm for students in the learning process, so that students become interested and focused in understanding their learning. Student focus will actually be directly proportional to ability (Pietrocola, 2019; Weaver et al., 2018).

In this research, the researcher also carried out an interview process with several students who were selected based on the researcher's considerations, namely that they had a big impact on the learning model provided. The results of interviews with several students showed that by using the creative problem solver model, it was easier for students to understand the material taught during learning and all of them expressed interest and it had an impact on their creativity in the physics learning process. The results of the interviews expressed by the students were clearly in line with the research results from quantitative data. Providing problems at the beginning before giving material, so that students can explore their own information that can be used to answer these problems. Wordwall assessment media also plays a role in addition to being interesting, it can help students train their ability to work on problems, especially those that are HOTS, so that students not only understand but in the application of working on problems students are able to solve the problems.

CONCLUSION

Based on the discussion of the research results of the Mann Whitney U nonparametric statistical test of students at SMAN Balung, it can be concluded that the physics HOTS ability of students with the creative problem solving learning model assisted by wordwall assessment media has a significant effect, this can be seen in the results of the mann whitney u nonparametric statistical test that the sig value. (2 tailed) of 0.001 for pretest data and 0.000 for posttest data which has a value smaller than the 0.05 significance level. It can be concluded that in this research the application of learning using the Creative Problem Solving Learning model accompanied by Wordwall as an assessment medium has an effect on students' problem solving abilities in solving problems that are high level thinking abilities. The existence of wordwall assessment media also helps train students in analyzing and solving problems related to physics. The abilities resulting from this learning model do not also influence students' learning interest and creativity in the learning process, according to additional data obtained by researchers from interviews where children in learning physics used the Creative Problem Solving Learning model Accompanied by Wordwall as Assessment Media to increase focus, interest and creativity in learning. Suggestions for future researchers to improve HOTS physics skills can be assisted with other interesting media that are more interactive, so that they can make students more active and think competitively and also other researchers also prepare research instruments and tools so that research can run and be carried out well.

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