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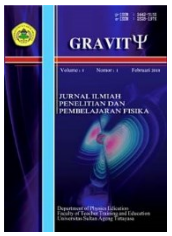

Online problem based learning (OPBL) assisted by simulation media in basic physics learning to improve creative thinking skills

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ABSTRACT

One of the lessons that have been affected by COVID19 is learning physics at every level of education, where physics learning which is usually done in person, is converted into online. In physics, teaching at educational universities is expected to produce science teachers who can think creatively like scientists. The purpose of this study was to see an increase in students' creative thinking skills using Online Probleme Based Learning (OPBL) learning with the help of simulations. This study used a one-group pretest-posttest design—analysis of research data by comparing scores of students' pre-test and post-test. The data analysis obtained that the average normalized gain score <g> creative thinking skills were 0.78 with the high category. Whereas <g> on each activity indicator, creative thinking skills are also in the high class, namely questioning skills of 0.88, guessing cause and effect 0.80, guessing the reason of an event 0.78, and improving the output of 0.87. So it can be concluded that OPBL, with the help of simulation media, can improve students' creative thinking skills with the high <g> category

Keywords: Creative thinking skills, online problem based learning (PBL), simulation

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INTRODUCTION

The reform from offline learning to online learning during the COVID 19 pandemic had a significant impact on education. One of the lessons that have been affected by COVID19 is learning physics. Physics learning is science learning, a basic science developed based on the results of scientific findings related to natural events that occur in everyday life at the level of primary education, secondary education, and higher education.

Higher education in tertiary educational institutions requires students to think scientifically like scientists to prepare prospective science teachers who can teach science by its essence. One of the compulsory subjects for future science teachers is fundamental physics. Each student is expected to have the basics of thinking, such as scientists' essential thinking, to carry out investigations to find explanations about natural phenomena both in face-to-face and online learning. One learning model that facilitates essential scientific thinking by physics learning is problem-based learning (PBL).

Research on the application of PBL has been carried out a lot, including looking at the influence of PBL on motivation and ability to

solve physics problems (Argau, Halile, Ayalew, & Kuma, 2017), looking at the impact of PBL on learning achievement and critical thinking skills (Mundilarto & Ismoyo, 2017), see PBL towards physics achievement (Bahri & Bakri, 2018). While PBL research, which is applied online, is still limited, one of which is Eldy and Sulaiman's analysis (2019) which uses PBL online and finds various obstacles, including the lack of readiness and motivation of students in the learning process, so that students find direct physics learning more enjoyable.

Therefore online PBL, or it can be called Online Problem Based Learning (OPBL), needs to be combined with various media that can increase student interest and motivation so that learning becomes more enjoyable (Wibowo et al., 2017a). One is a simulation media that can simulate microscopic physical phenomena (Wibowo et al., 2016).

Research on the benefits of simulation has been researched by other researchers before, including simulations that can represent mathematically theoretical physics (Darman et al., 2019a), simulations can improve students 'conceptual understanding of heat transfer material (Wibowo et al., 2016), simulations can reconstruct students' physics concepts (Darman et al., 2019b). They can support problem-solving activities (Wibowo et al., 2019). So that by understanding students the concepts of physics will make it easier for students to think creatively in solving problems found in everyday life (Dewi et al., 2020)

Based on the description above, if OPBL is combined with simulation media in physics learning in tertiary institutions, it is hoped that the simulation media used will increase understanding which in turn will increase students' creative abilities. So that research on Online Problem Based Learning (OP Research Simulation Media in Basic Physics learning to improve Creative Thinking skills needs to be done. This study aims to see how to increase prospective teacher students' creative thinking skills using OPBL learning with the help of simulations. In this study, it was seen that the increase in students' creativity abilities before and after OPBL learning.

RESEARCH METHODS

The method used in this research is the initial experimental method or pre-experiment. This method was chosen according to the research objectives, which only wanted to see the impact of the OPBL application on the improvement of students' creative thinking skills, not to test its effectiveness compared to the use of other learning models.

This study used a one-group pretest-posttest design. With a plan like this, the research subject is one experimental class without comparison. In the one-group pretest-posttest design, the single subject group was given a pretest/pre-test (O), treatment (X), and posttest / final test (O). The pretest and posttest instruments were the same but were given at different times. The design form is as shown in Figure 1 .

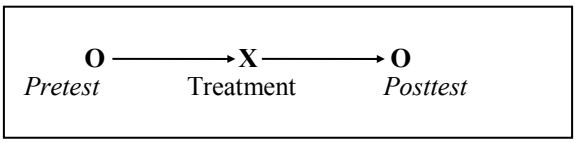

Figure 1. One-Group Pretest-Posttest Research Design

Information :

O: The Initial Test *(pretest)* is the same as the Final Test *(posttest)*

X: Application of *Problem Base Learning Learning*

Respondents of this study were student teacher candidates who took introductory physics courses in odd semesters at the Teacher Training and Education Faculty, Sultan Ageng Tirtayasa University, with 36 students taken by purposive sampling, namely the technique of determining the sample with specific considerations. The considerations in question are the activity, learning response, enthusiasm, and participation of prospective teacher students.

The stage taken in this research includes five steps, namely: a preliminary study, implementation, data collection techniques, and ends with the analysis of results and preparation of reports. The research instrument used has been tested for reliability,

discriminating power test, and test for the level of ease in previous research. It has met the validity, reliability, and distinction criteria that meet the instrument's feasibility for analysis.

The preliminary study is intended to determine the development of fundamental physics learning in tertiary institutions. This preliminary study was carried out by looking at students' low creative thinking skills who took fundamental physics MK the previous year. Apart from that, the utilization of physics learning models using OPBL online with simulations has not been widely reported.

A literature study was conducted to examine the findings of previous studies. This study was also undertaken to find theories related to students' creative thinking skills in the learning process, which were also described in the criteria for assessing creative thinking skills. The results of the literature study, then, are used as the basis for conducting OPBL research.

The results obtained from the literature and preliminary studies are used to prepare the initial product (draft). Prepare a learning implementation plan (RPP) and OPBL student worksheets (LKM). Also, an appropriate simulation is prepared by the topic to be studied, namely the material's heat and thermal properties.

After all the learning devices have been made, a pre-test of students 'creative thinking skills is carried out to see their creative thinking abilities before implementing OPBL learning. After that, the implementation of OPBL physics learning was carried out for odd semester students of Sultan Ageng Tirtayasa University. After the implementation -semester, a post-test of creative thinking skills is carried out using the same questions as the pre-test to see the increase in students' creative thinking skills.

After the post-test is caincreaselysis is carried out by collecting and storing the data that has been obtained. An analysis of the information is carried out, and the discussion is carried out and conclusions are taken. The flow of the research carried out is shown in Figure 2

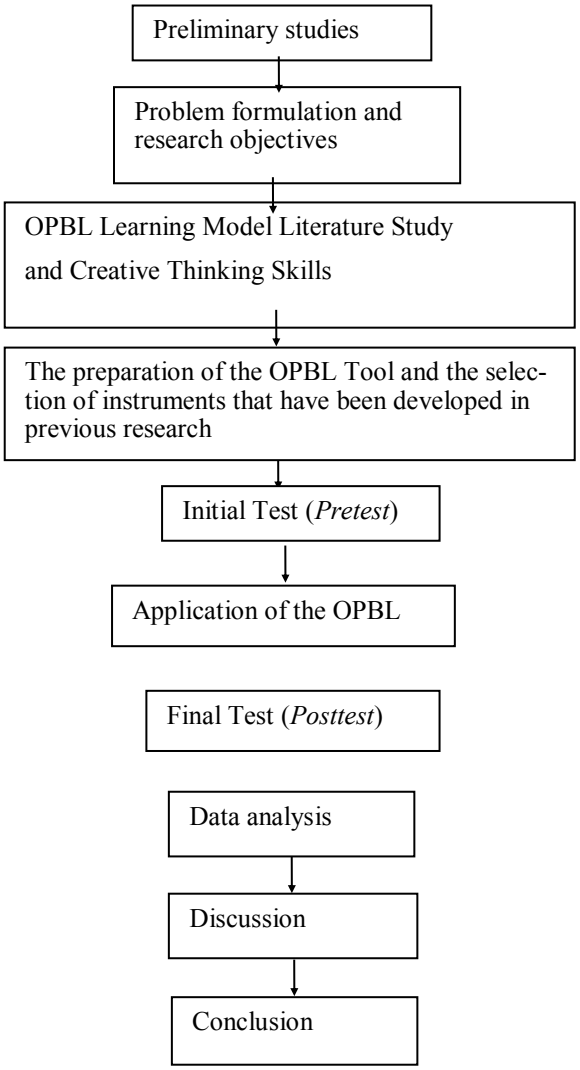

Figure 2/ OPBL Research Flow

Primary data of student test results before and after treatment were analyzed by comparing the initial test scores and the final test. The increase that occurs before and after learning is calculated by the formula for the gain factor (g) developed by Hake (1999) with the formula (1)

$$g = \frac{S_{post} - S_{pre}}{S_{maks} - S_{pre}} \quad (1)$$

Information :

S_{post} : final test score
S_{pre} : initial test score
S_{maks} : maximum score

The normalized gain criteria are shown in Table 1

Table 1. Gain criteria normalized

G	Criteria
$g \geq 0,7$	high
$0,3 \leq g < 0,7$	Moderate
$g < 0,3$	low

Processing and data analysis of the average gain score normalized the results of students' creative thinking skills applied to OPBL learning with the help of simulation media on the concept of heat and thermal properties of the material using statistical tests by calculating the average normalized gain score <g>. The improvement of students' creative thinking skills developed through learning is calculated based on the average normalized gain score <g> (Hake, 1999) with equation (2)

$$< g >= \frac{< S_{post} > - < S_{pre} >}{< S_{maks} > - < S_{pre} >} \qquad (2)$$

Information :

$<S_{post}>$: average final test score

$<S_{pre}>$: average initial test score

$<S_{maks}>$: average maximum score

Data processing of normalized average gain score was statistically analyzed using Microsoft Office Excel 2019 software.

RESULTS AND DISCUSSION

Students' thinking skills for each activity can be seen from students' test scores on each item given in the pre-test and the final test virtually. According to Marwanti, Suherman, Wibowo, Darman, and Guntara (2020), the test can effectively improve test taker's job skills to be used as a test tool when a direct test cannot be carried out.

The number of questions used consisted of 10 description items, which tested the four activities included in creative thinking skills. Specifically, the indicators of creative thinking skills assessed in this study are focused on four creative thinking skills activities. The four movements are (1) questioning activity which consists of two questions, (2) guessing the causes, which consists of five questions, (3) assuming the consequences, which consists of two questions, and (4) correcting activity. The output consists of one question. The results of the assessment of creative thinking skills in the form of average student scores can be seen in diagram figure 3

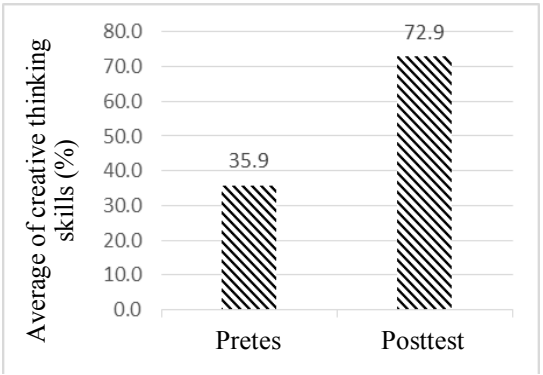

Figure 3. Bar chart mean of pre-test, the average final test of creative thinking skills

Based on Figure 3, information is obtained that the average initial test score, the average final test score, and the average normalized gain score <g>, students' creative thinking skills after applying the OPBL physics learning model assisted by simulation Average score. The initial test of students 'creative thinking skills before learning was 35.9% of the ideal score of 10. The average score of the final test of students' creative thinking skills after learning was 72.9% of the perfect score of 10.

The average normalized gain score <g> creative thinking skills can be seen in Figure 4 . Based on Figure 4, information is obtained that the average normalized gain score <g> of students' creative thinking skills is 0.78. If confirmed by the gain category from Hake (1999), it is in the high class. This shows that the average increase in students' creative thinking skills after implementing the OPBL physics learning model assisted by simulation media is in the high category.

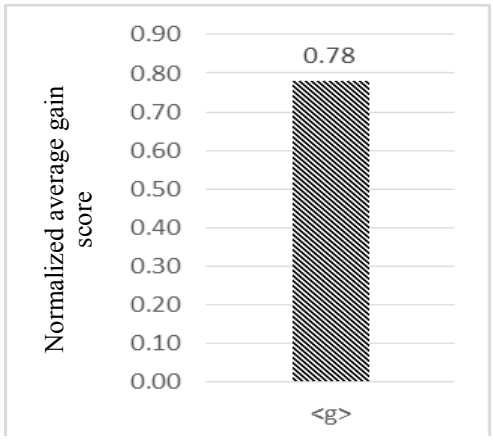

Figure 4. Bar chart of normalized average gain score <g> creative thinking skills

In addition to improving students 'creative thinking skills in general, it was also seen an increase in every activity of students' creative thinking skills. This can be seen from students' test scores on each item given in the pre-test and in the final test, which tests for each activity of creative thinking skills. The number of questions used consists of 10 description items. The average initial test score and the aver-

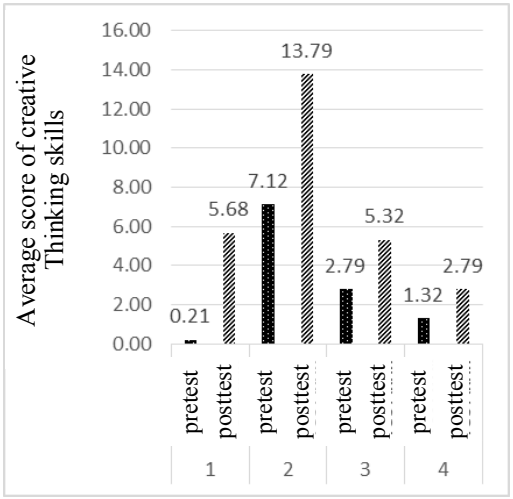

Figure 5 Bar Chart of Average Initial Test, Average Final Test, Each Creative Thinking Skills Activity

Based on Figure 5, it is obtained information on the average score of students' creative thinking skills test in each creative thinking skills activity. The students' initial test score in (1) asking questions was 0.21 from the ideal score of 6. Activity (2) guessing the cause of an event was 7.12 from the perfect score of 15. Activity (3) thinking an event's result was 2, 79 from the ideal score 6. Activities (4) improve the output of 1.32 from the perfect score of 3. The average final score of the questioning activity is 5.68, from the ideal score of 6. The movement of guessing because of an event is 13.79 from the perfect score of 15. Thinking activity as a result of an event, amounting to 5.32 from the ideal score of 6. Exercises to improve the output of 2.79 from the perfect score of 3.

The normalized average gain score <g> for each indicator of creative thinking skills can be seen in the diagram in Figure 6.

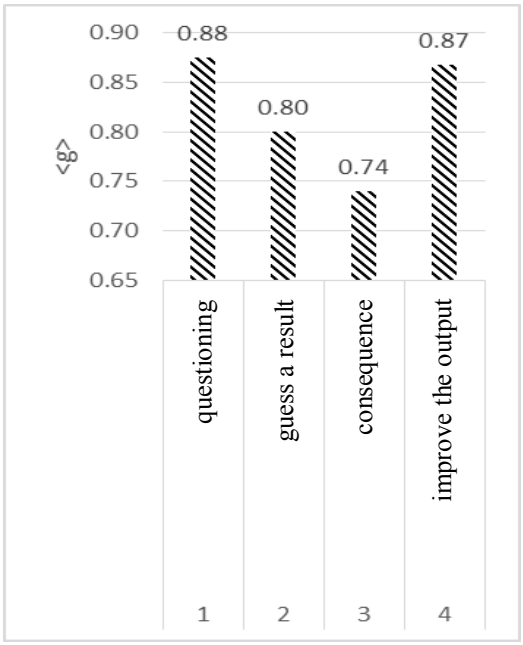

Figure 6. Bar chart of normalized average gain score <g> for each activity of creative thinking skills

It can be seen that in Figure 6, normalized gain <g> in the creative thinking skills activity of asking questions is 0.88, which is in the high category. On the indicator guessing cause and effect, normalized Gain <g> is obtained of 0.8. In the guessing indicator, the cause of an event is brought normalized Gain <g> of 0.74. Meanwhile, the hand of improving the output obtained normalized Gain value

<g> of 0.87.

From these data, the highest normalized gain score average on the indicator of creative thinking skills occurs in the questioning activity of 0.88. The lowest is in hand, guessing the consequences of an event. However, if confirmed by Hake's gain category (1999), every indicator of student creative thinking is included in the high class. This shows that the creative thinking skills in each student activity increase with a high category after applying the animation-assisted OPBL physics learning model.

The high average normalized gain score <g> is supported by the PBL learning application added with simulation. PBL gives students a positive attitude towards learning physics (Bedemo, 2020). This learning presents contextual problems that stimulate students to learn and practice solving various physics science problems that require creative thinking (Wibowo and Suhandi, 2013).

Prospective teachers need creative thinking in applying their knowledge when teaching science concepts, especially physics (Bedemo, 2020). Because when training, the teacher is expected to use PBL in learning to practice higher thinking skills.

Another factor that supports the high <g> gain is the provision of OPBL worksheets during learning to make students more trained in creative thinking. When doing the posttest, it is easier for students to complete the four creative thinking activities given.

CONCLUSION

This study concludes that the average normalized gain score <g> of students' creative thinking skills is 0.78. When confirmed by the gain category from Hake (1999), it is in the high class. When viewed for each indicator of creative thinking, the indicator of creative thinking skills to ask questions is 0.88, the guessing indicator for cause and effect is obtained normalized Gain <g> of 0.80, the hand guesses the reason of an event obtained Normalized Gain <g> of 0, 74, and the indicator of improving the output got normalized Gain value <g> of 0.87. From the results of normalized Gain value <g> for each hand of creative thinking skills, it can be concluded that normalized Gain <g> indicates a high category even though there is a slight difference in value. This shows that the average increase in students' creative thinking skills after implementing the OPBL physics learning model assisted by simulation media is in the high category.

REFERENCES

Argau, A.S., Haile, B.B., Ayalew,B.T., & Kuma,S.G. (2017). The Effect of Problem Based Learning (PBL) Instruction on Students' Motivation and Problem-Solving Skills of Physics. *EURASIA Journal of Mathematics Science and Technology Education*, 13(3), 857-871

Bahri, S., & Bakri, F. (2018). Implementation of Problem-Based Learning to Improve Physics Learning Outcomes of Class X IPA-4 in SMA 59. *Jurnal Penelitian & Pengembangan Pendidikan Fisika*, *4*(1), 35 - 46.

Bedemo, S.(2020). Effects of Problem Based Learning on Students' Achievement and Attitude Towards Physics (Mechanics): The Case of Gilgel Beles College of Teachers Education, *Science Journal of Education*, 8 (3), 71-81

Darman, R.D., Wibowo,F.C., Suhandi, A., Setiawan, W., Abizar, H., Nurhaji, S,… Standard, A. (2019a). Virtual media simulation technology on the mathematical representation of sound waves, *Journal of Physics: Conference Series,* 1188 (1),1-8

Darman,D.R., Suherman, Anriani,N., Wibowo, F.C., Faizin, M.N., Samsudin,A., ...Nurhaji, S. (2019b). Effectiveness of learning support of asset (assessment simulation test) for reconstruction physics conception. -*Journal of Physics: Conference Series* 1280 (5), 052063

Dewi,S.S., Suherman,S., Wibowo, F.C., Darman, D.R., Rino, A.P.A., Darmawan, I.A. (2020).Designing MOOCs with VMS (Virtual Microscopic Simulation)

for Measurement Student's Level Understanding (LU). *Jurnal Penelitian & Pengembangan Pendidikan Fisika,* 6 (10). 17-24

Eldy, F.F.,& Sulaiman F.(2019). PBL Online Learning in Thermodynamics and Statistical Physics: Students' Readiness. InternationalJournal of Engineering and Advanced Technology (IJEAT), 8 (6S3), 355-359

Mundilarto., & Ismoyo, H (2017). Effect Of Problem-Based Learning On Improvement Physics Achievement And Critical Thinking Of Senior High School Student**.** *Journal of Baltic Science Education*, 16 (5), 761-779

Marwanti,K., Suherman,S., Wibowo, F.C., Darman, D.R., Guntara, Y. (2020). Assessment Virtual Test (ACTIVE): Assessment Virtual Based on Interactive Lecture Demonstration (ILD) to Support Employability Skills. Jurnal Penelitian & Pengembangan Pendidikan Fisika, 6(1), 1-8

Samsudin, S., Liliawati, W., Sutrisno, A.S., Suhendi, E., Kaniawati, I. (2015). The use of computer simulation in cooperative learning to minimize students' misconceptions of momentum and impulse. *International Conference on Advances in Education Technology (ICAET*) (14),72-74

Wibowo, F.C., & Suhandi, A. (2013). Penerapan model Science creative learning (SCL) fisika Berbasis proyek untuk meningkatkan hasil belajar Kognitif dan keterampilan berpikir kreatif. Jurnal Pendidikan IPA Indonesia, 2 (1), 67-75

Wibowo, F.C., Suhandi,A., Rusdiana,D., Darman, D.R., Ruhiat,Y., Denny, Y.R.,… Fatah, A.(2016). Microscopic virtual media (MVM) in physics learning: A case study on student's understanding of heat transfer. *Journal of Physics: Conference Series*,739 (1), 1-6

Wibowo, F.C., Suhandi, A., Rusdiana, D., Ruhiat, Y., Darman, D.R., & Samsudin, A.(2017a). Effectiveness of Microscopic Virtual Simulation (VMS) for Conceptualizing Students' Conceptions on Phase Transitions. *Advanced Science Letters*,23 (2), 839-843

Wibowo,F.C., Suhandi,A., Rusdiana,D., Samsudin, A., Darman, D.R.,…Hidayat, S.(2017b). Effectiveness of Dry Cell Microscopic Simulation (DCMS) to Promote Conceptual Understanding about Battery. *Journal of Physics: Conference Series,* 877(1), 1-10

Wibowo, F.C., Budi, E., Siswoyo, Sunaryo, Raihanati, Sanjaya, L,… Costu, B. (2019). Unveil virtual physics laboratory (VPL) with microscopic battery simulation (BMS) promotes problem-solving activity. AIP Conference Proceedings, 2169 (1), 020015(1-6)