# THE APPLICATION OF PROBLEM-BASED LEARNING MODEL BASED ON MADURA'S LOCAL WISDOM TO IMPROVE STUDENTS HOTS IN PHYSICS SUBJECT

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## Abstract

This study aims to describe the implementation of learning and results from HOTS improvement of students after the PBL learning model based on Madura's local wisdom was applied to Physics subjects. Design of this study using pre-experimental with one group Pre-test-posted. The subject of this study there is three classes with one experimental class and two replication classes. The implementation of learning is analyzed from the learning implementation sheet. HOTS enhancement of students is known from the results of the pre-test and post-test analyzed using t-test parametric statistics in pairs, and proceed with calculating the normalized gain value to find out the improve in HOTS learners. The results of the study showed that learning was carried out very well and there is a significant improve in HOTS of students after the PBL learning model based on Madura local wisdom was applied . HOTS improve in students is in the high category with an average the score gain is 0.804.

Keywords: Problem Based Learning (PBL), Madura's local wisdom, Higher Order Thinking Skills (HOTS)

## Abstrak

Penelitian ini bertujuan untuk mendeskripsikan keterlaksanaan pembelajaran dan hasil peningkatan HOTS peserta didik setelah diterapkan model pembelajran *PBL* berbasis kearifan lokal Madura pada mata pelajaran Fisika. Rancangan penelitian ini menggunakan *pre-experimental* dengan *one group Pre-test-postet*. Subjek penelitian ini berjumlah tiga kelas dengan satu kelas eksperimen dan dua kelas Replikasi. Keterlaksanaan pembelajaran dianalisis dari lembar keterlaksanaan pembelajaran. Peningkatan HOTS peserta didik diketahui dari hasil *Pre-test dan Post-test* yang dianalisis menggunakan statistik parametrik uji t berpasangan, dan dilanjutkan dengan menghitung nilai gain ternormalisasi untuk mnegetahui besar peningkatan HOTS peserta didik. Hasil penelitian menunjukkan keterlaksaan pembelajaran terlaksana dengan sangat baik dan terdapat peningkatan HOTS peserta didik yang signifikan setelah diterapkan model pembelajaran *PBL* berbasis kearifan lokal Madura. peningkatan HOTS peserta didik berapa pada kategori tinggi dengan rata-rata perolehan score ngain sebesar 0.804.

Kata kunci: *Problem Based Learning (PBL),* Kearifan lokal Madura, *Higher Order Thinking Skills (HOTS).*

## INTRODUCTION

The era of globalization has an impact on almost all aspects of life, education and culture are two of them. The challenge of Education in the 21st century is one of the impacts of globalization in the field of Education requires students to have high-level thinking skills to face the world in the future.

This 21st century Education Challenge is the basis for improving the Education curriculum in Indonesia, namely the Revised 2013 curriculum. This is by Permendikbud No. 59 of 2014 concerning 2013 School Curriculum Middle School / Madrasah Aliyah in Appendix states that one of the bases for improving the curriculum is internal and external challenges. Furthermore, in the Minister of Education and Culture Regulation Number 21 the Year 2016 concerning standard content there is a description of knowledge that requires students to have high-level thinking skills such as analyze and evaluate.

In the term of education, high-level thinking skills are closely related to levels of cognition or ones we are familiar with Bloom's taxonomy. This theory was put forward by Benjamin S. Bloom in 1956 which was later revised by Anderson. In Bloom's taxonomy, high-level

thinking skills are classified at the level of analysis (C4), evaluate (C5), and create (C6).

Indonesia's participation in the Program for International Student Assessment (PISA) 2015 carried out by Organization for Economic Cooperation and Development (OECD) shows the average value obtained by Indonesian students is 403, where the value makes Indonesia ranked in the 62 of 70 countries when viewed from the performance of science students. The value of Indonesian students is still low when compared with the value of Singapore students (556) who ranked first in PISA (OECD, 2015). The items in the PISA test require students to use the ability to analyze, evaluate, creating, using logic and reasoning. This capability requires HOTS inside according to the acquisition, it can be detected that almost all Indonesian students with the age of 15 years still has a low HOTS ability when viewed from the performance of science.

On the other hand, Globalization must also be responded wisely so that students get to benefit from globalization without eliminating the existence of Indonesian local culture. The 2011 PPMP study (Mardiyana, 2011) shows the difficulties of students in learning physics one of which is caused by the material content of physics tends to be adopted from the West. The underlying culture Western science development is not the same as local culture, so science learning has the potential to cause gap (clash) between scientific science with local science.

One of the regions in Indonesia that has a very strong local expertise is Madura. This matter allowing research to be able to integrate Madura culture with the learning model supports the achievement of the 2013 curriculum objectives. Madura culture is very prominent than another Madurese culture is the "karapan sapi" . "karapan sapi" is considered suitable to be integrated with Newton's Law material about motion in high school lessons.

Pre-research results conducted at SMAN 2 Bangkalan indicate that students view Physics lessons are quite difficult and not very interesting lessons, this is because they think physics lessons are too many formulas, and not very useful in true life, physics lessons at schools are also rarely associated with the local culture of Madura. Until now there has not been much research that integrates Madura local wisdom into learning, even though learning developed using local wisdom is very good, elements of local wisdom exist in each culture that can be introduced and modeled in the learning process. Based on the description above, researchers are interested in researching the Application of Problem Learning Models Based Learning (PBL) based on Madura's local wisdom to Improve Higher Order Thinking Skills (HOTS) of 10th Class Learners in Physics Subjects.

**METHOD**

Data collection is done at SMA 2 Bangkalan in the even semester of the 2018/2019 academic year. The method used was pre-experimental with one group pre-test post-test design. The research design can be seen in table 1

**Table 1:** Reaserch Design

| Class | *Pretest* | Treatment | *Postest* |
|---|---|---|---|
| **Experiment** | $O_1$ | X | $O_2$ |
| **Replication 1** | $O_1$ | X | $O_2$ |
| **Replication 2** | $O_1$ | X | $O_2$ |

(Suharsimi, 2013)

Information:

$O_1$: pre-test

X :given treatment by applying Problem Based Learning (PBL) based on Madurese local wisdom.

$O_2$: post-test

Data of Implementation learning obtained from the total score given by observers through observation during the learning process takes place on learning coercion sheets. Based on (Riduwan, 2013) the Learning Implementation can be known by use the following formula:

$$\text{Implementation} = \frac{total\ score}{maximal\ score} \times 100\%$$

While the HOTS ability data of students was obtained from the question instrument in the form of 9 questions which were described integrated with Madura local wisdom with analyzing levels (C4), evaluating (C5), creating (C6). The instrument of this question is used as the initial test (pre-test) and the final test (post-test). The question instrument used has been tested to students of class XI of SMAN 2 Bangkalan to obtain external validity and reliability question. then the data obtained from the results of the post-test pre-test were tested using t-test parametric statistics in pairs. To find out the improve in HOTS of students, the calculation of the n-gain value is done.

**RESULTS AND DISCUSSION**

Problem Based Learning Model has a syntax that must be implemented. Based on (Arends, 2012) PBL syntax has 5 steps, namely: step 1 orientation of students on the problem, step 2 organizing students, step 3 guides the investigation, step 4 develops and presents the work, step 5 analyzes and evaluate the problem-solving process. The syntax of PBL is outlined in the RPP that is integrated with Madura local wisdom, namely "karapan sapi". The syntax of PBL was divided into 3 times of sequences during the study. In a manner, all learning implementation can be seen in figure 1.
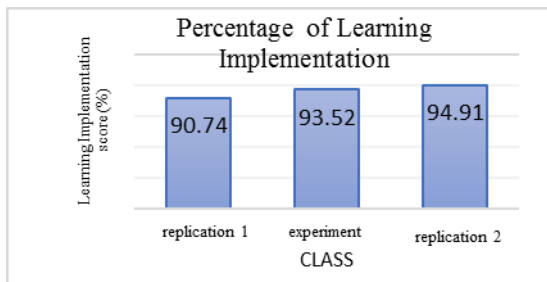
**Figure 1:** Percentage of Learning Implementation

Based on Figure 1, it can be seen that the percentage of learning implementation in the three classes is above 90%. Based on (Riduwan, 2013) The implementation of learning is carried out in a very good category. This matter is possible to occur because all the steps in the PBL syntax have been carried out.

At the first meeting, the teacher carries out 3 steps, The first step, the teacher demonstrates the event physics in true life in the form of inertia, in this activity students are also allowed to engage and try in demonstration activities. In the second step, the teacher divides students into 6 groups and organize learning assignments related to problems. In the third step, the teacher shows the video Madura's "karapan sapi" as material for discussion and investigation to get information about Newton's First Law, Newton's Second Law, and Newton's Third Law.

At the second meeting, the teacher carried out the fourth step, the students presenting the results of the investigation from the video of the phenomenon of "karapan sapi". Next, the teacher guides students to design traditionally toy from Madura named " pesapean", this toy has a working principle almost the same as karapan sapi which are actually. From the product design that has been made students continue to make projects at home then displayed and used as a practicum at the next meeting.

At the third meeting, the teacher continues the fourth step of developing and presenting the work. On this step, students exhibit products that have been made then experiment using the product. In the last step the teacher reflects on the findings during the learning process, one of the interesting things that are related to students' understanding about Force ($\vec{F}$) which is proportional to the acceleration ($\vec{a}$) of objects, and inversely proportional to the mass of the object (M). Some students mistakenly apply this principle in the context of "karapan sapi" so that they consider the races of cows using larger cows have smaller accelerations because the adult cow has a larger mass. Next, for learning evaluation, the teacher does post-test for students.

HOTS enhancements of students were obtained from the results of the paired the t-test the pre-test and post-test students results. HOTS enhancements of students are analyzed by a hypothesis:

$H_0$ = There is no significant improve in HOTS of students
$H_1$ = There is a significant improve in HOTS of students

The testing criteria are H 0: accepted if t count <t table, and H 0: rejected if $t_{count} > t_{table}$. The results of the t-test analysis on experimental class, replication class 1, and replication class 2 can be seen in table 2

**Table 2:** T-test results in pairs

| Data source | class | T value | $t_{tabel}$ | Conclution |
|---|---|---|---|---|
| *pre-test & post-test score* | Experiment | 37.759 | 2.0320 | $H_0$ is rejected |
| | Replication 1 | 25.620 | 2.0320 | $H_0$ is rejected |
| | Replication 2 | 41.688 | 2.0345 | $H_0$ is rejected |

Based on Table 2, it can be seen that there is a significant improvement in HOTS of students in the class experiment and replication classes 1 and 2 after the PBL learning model based on Madura local wisdom was applied. This is supported by research conducted by (Jayanti et al., 2016) in his conclusion that PBL models through the POE method have a positive effect and can improve participants' high-level thinking skills students.

The improve in HOTS ability of students in each class is known through the calculation of n-gain. The results of the n-gain score can be seen in Figure 2.
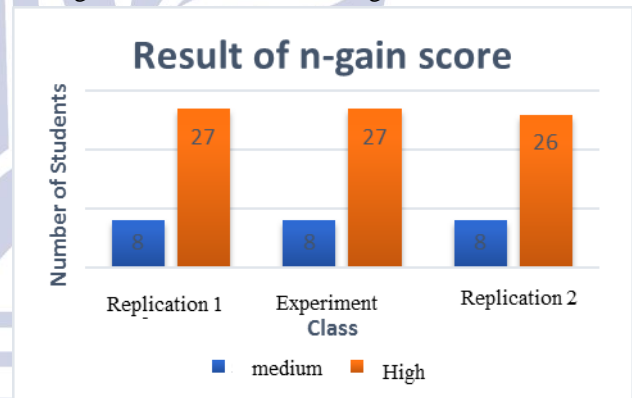


**Figure 2:** Result of n-gain score

Based on Figure 2 it can be seen that in the experimental class, 8 students experienced HOTS improve in the medium category and 28 students experienced HOTS improve in the high category, the high improvement of students HOTS is also reinforced by the replication class 1 and Replication 2. Overall, the average n-gain value is 0.804. based on (Hake, 1999) an improve in HOTS participants the student is in the high category.

Students HOTS has significant improvements in high categories that can occur because it is based on analysis the implementation of learning shows that the model of Problem Based Learning is based on local wisdom Madura is carried out with very good criteria. The characteristics of the PBL model support the

activities of students for conduct investigations, produce products, and collaborations, which support to train components - high-level thinking component. This is supported by a statement (Arends, 2012: 396) that the essence of PBL is presenting to students an authentic and meaningful problem that can function as material investigation. One of the characteristics of PBL is that authentic inquiry requires students to look for real solutions for real problems, they must analyze information, conduct experiments and conclude.

Besides the syntax of PBL also requires students to analyze a problem or phenomenon, discuss, produce a product and also evaluate the learning process. it satisfies that level of cognition categorized as Higher Order Thinking Skills (HOTS) according to (Anderson, 2001) namely analysis (C4), evaluation (C5) and also creates (C6). HOTS of students improve also due to the understanding of their concepts that improve after the application of learning that is integrated with local wisdom, this is supported by the research conducted (Satriawan & Rosmiati, 2018) which stated learning tools integrated to local wisdom can improve the conceptual understanding of students.

Learning tools that are integrated with Madura's Local wisdom also play a role in influencing HOTS students this is following one of the principles of contextual learning according to (Nurdyansyah, 2016) which is inquiry where knowledge of students is obtained through observation, asking questions, propose hypotheses, collecting data, and conclude. These activities have also been carried out during the learning process. This is according to a statement (Jhonson, 2002) that the components of contextual learning include critical and creative thinking, and make meaningful links. The statement was also reinforced by research conducted by (Ragilia, et al., 2018) entitled " Development of Problem Based Learning Learner Worksheet to Improve Models Critical Thinking Ability " in the results of his research shows the PBL model learning worksheet is effective for improving students' critical thinking skills. The same thing was also revealed in the results of the study (Prasiwi, 2018) that the developed LKPD can be used to train students' critical thinking skills.

Based on the results of analysts, the improve in HOTS of students shows that the Problem Based learning model based on local wisdom Madura can improve high-level thinking skills / HOTS students.

**CONCLUSION**

Based on the results of the analysis and discussion of the study, it can be concluded that the Problem Based Learning (PBL) model based on local wisdom Madura is implemented very well. And there is a significant improvement in students' Higher OrderThinking Skills

(HOTS) with the acquisition of an average n-gain score is 0.804 after applied Problem Based Learning (PBL) learning model based on Madura local wisdom.

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