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Analysis of Science Literacy and Adversity Quotient on the Implementation of Problem Based Learning Model Assisted by Performance Assessment

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Abstract

Science literacy is one of the problems of education in Indonesia that needs attention to be resolved immediately. The ability of science literacy in Indonesia is still low, which is evidenced by the International agency Organization for Economic Cooperation and Development (OECD) through the Programme for International Student Assessment (PISA) to Children aged 15 years. This study aimed to (1) determine the effectiveness of Problem Based Learning (PBL) aided by Performance Assessment of students 'scientific literacy abilities and , (2) to describe the students' scientific literacy abilities reviewed by Adversity Quotient (AQ). This research used a quasi-experiment with a pretest-posttest control group design. The sample of this study ware students IV A (experimental group) and class IV B (control group) in SDN 1 Purwawinangun Cirebon. In this study data were taken using test instruments and questionners. Data analysis used were the normality test, the homogeneity test, and the average similarity test. Obtained data indicate that the class taken as samples in this study were normally distributed and have homogeneous variances. It means that the sample comes from the same condition that was having the same knowledge. N-gain test showed that the experimental group was 0.31 score as the medium category and the control group was 0.29 score as the low category. The finding showed that PBL model aided by performance assessment was effective for increasing students' scientific literacy ability were which indicated by student's with PBL learning aided by performance assessment was by achieving complete scientific literacy on PBL aided by performance assessment better than students on PBL. The pattern of science literacy ability reviewed by AQ; a) climber students type were able to master both of the aspects applying and designing problem strategies. b) camper type students were mastered both of the aspect reasoning and able analyzed that given problems. c) quitter type students have ably mastered only the knowing aspect.

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INTRODUCTION

Partnership for 21st Century Skills (P21). Proposed the competencies needed in the 21st century, namely "The 4Cs" – those are communication, collaboration, critical thinking, and creativity. These competencies are important to be taught to students in the context core of subject areas and themes of the 21st century. Science is the key to the development of Science and Technology, so that science has no doubt becomes a very important aspect in various aspects of human life.

Science education is an instrumental in creating a reliable and qualified young generation in the face of the globalization era. Some countries have established science literacy as a science education objective. The ability of science literacy can be defined as an individual's ability to identify those that include science facts, using the appropriate investigation methods to obtain the necessary scientific evidence, and the ability to Analyze and interpret the evidence so that it can be obtained a meaningful conclusion (Kharida *et al.*, 2009).

Learning was focused on achieved of scientific literacy that learning by following the essence of science learning which was learned do not merely emphasize memorization but was oriented to the process and achievement of scientific attitudes (Yuliati, 2017). Science literacy was the ability for thinking scientifically and used scientific knowledge and processes which understood natural phenomena so that they can make decisions for solving the scientific problems faced by themselves (Arif, 2015).

Scientific literacy as a requirement that must be contracted for students that adjusting the challenges of rapidly changing times so that learning in scientific literacy was trained in tandem with the development of life skills Holbrook & Rannikmae, (2009). According to the Program for International Student Assessment (PISA), scientific literacy was used the capacity of scientific knowledge and abilities, identified questions and draw conclusions based on available evidence and data in order to understand the universe and help for making decisions about changes that occur due to interaction humans and their nature (OECD, 2013).

TIMSS was an international study that measured students' abilities in mathematics and science. TIMSS aimed to see the achievements of students, especially in the fields of mathematics and science based on the curriculum that was planned and implemented by each country. Cognitive dimensions according to TIMSS 2015 were divided into 3 domains describing students' think less processes.

The first domain, knowing those were recalled/recognized, described, and provided examples. The second domain was applying focused on the use of knowledge to produce explanations and for solving problems with indicators compared/contrasted/classified, relate, used models, interpreted information, and explained. The third domain was reasoning included analyzed, synthesized, formulating questions/hypotheses/ predicted and designed investigation.

The three cognitive domains were used a target percentage for each domain that varies between grades four and eight suitable with cognitive abilities, instruction, experience, breadth, and depth of the student understanding at high-order levels. Indicator of Literacy science were presented in Table 1.

Table 1. Indicator of Literacy Science

Indicator	Sub Indicator
Knowing	recall/recognize
	Describe
	provide examples
Applying	compare/contrast/classify
	Relate
	use models
	interpret information
	Explain
Reasoning	Analyse
	Synthesize
	formulate question/ hypothesize / predict

Based on PISA the scientific literacy ability of Indonesian students was still low if compared with the international of the mean score and commonly was at the lowest stage by PISA measurement. Since three times followed by the PISA of scientific literacy assessment from 2012-2018 Indonesia was ranked 64 out of 65 countries

with a mean score was 382 in 2012, then in 2015 Indonesia was ranked 62 out of 70 participants with a score was 403 (OECD, 2015).

According to Ogunkula (2013), increased scientific literacy in science learning by connecting a science concept with topics were developing and interesting in real life. Students were expected to be active in learning by using new and interesting topics in real life. The solution considered appropriate to overcome the above problems was applied a science learning model that be able encourage students to build their own concepts. Through learning with a scientific approach students were engage with contextual, phenomena by involving aspects of the students' daily life, and utilized the natural environment, social environment, and the local potential which students were located, so as for enhancing students' scientific literacy abilities (Suastra, 2010).

Problem Based Learning (PBL) was learning that give opportunity for students to choose their research to enable them related to it in the real phenomena and built understanding with the concepts got from the phenomenon by them. PBL also was trained students to learn to become "adults" who taken important roles in society to overcome various problems faced in various real-life situations (Arends, 2008: 43).

Research conducted by Eviani *et al.*, (2014) showed that the learning of science literacy using a problem based learning is said to be 0.42 category in gain. Mariana. & Andi (2018) research suggest that the problem based learning influence on science literacy shows that student learning result are in high category. Widyaningrum (2016) research shows that learning by using the problem based learning increases in every cycle.

Beside the learning model, assessment of student performance also affected the quality of learning outcomes. Performance assessment was a procedure that used assignments or exercises to get information about how a student learns well (Nitko, 1996: 239). Assessment was a general term and included all the methods commonly used to determine the success of student learning by assessing the performance of the individual students or groups. The assessment was obtained various kinds of information about the extent of student learning outcomes or information about the achievement of student competencies.

In theory, the model and performance assessment individually can improve student learning achievement, so it both model were combined, it will also be able was increased student scientific literacy. The model based on performance assessment referred to student-centered activities in which the learning activities were student-centered and the assessment was based on tracing in the product. The intended product was the work results shown in the learning process. If it happens on an ongoing basis, then by itself students were able to criticize the level of understanding of the concepts they have learned based on the product produced.

Inappropriate used of learning models in the learning process will lead the low level of scientific literacy it can be resulted from students' attitudes in responding to the material provided by the teacher or overcoming problems encountered in solving problems. The ability of students was responded to the material provided by the teacher was also known as Adversity Quotient (AQ).

AQ was a potential/ability or a form of intelligence that lies behind personable changed obstacles or difficulties into an opportunity. Stoltz (2003) was classified problem solving abilities in 3 categories of AQ, namely: climbers, campers, and quitters.This attitude was needed to be instilled in every student in learning to be able to survive and try to find out the solutions in dealing with a problem (Wiraningsih *et al.*, 2018).

The student who has AQ category climber that had good mathematical problem-solving abilities, while students who have AQ category camper that had mathematical problem-solving abilities classified as sufficient well. (Ismawati & Hindarto, 2017). Anik. (2019) The results showed that the student intelligence adversity (AQ) scores still tend to be low if compared with the ideal maximum score. Students in the climber category are far better at solving problems given by the teacher. Based on the description above, the formulation of the problem in this study was:

1). How is the scientific literacy ability of students at elementary school of using the Problem Based Learning model aided by performance assessment?
2). How is the AQ of students at elementary school through science literacy?

This research aims to find out how literacy content in the PBL model and see the student AQ on each indicator.

METHODS

The research used a quantitative design with a pretest-posttest control group design. There were two groups were randomly selected, then given a pretest to find out the initial stage. A good pre-test result if the score of the experimental group was not significantly different. The effect of the treatment was (o2-o1) - (o4-o3) were presented in Table 2.

Table 2. Pretest-Posttest Control Group Design

Group	Pretest	Treatment	Posttest
Experiment	O_1	X	O_2
Control	O_2	-	O_4

This research conducted at SDN 1 Purwawinangun Cirebon Regency at class IV with 8 sub-themes 1 in learning 2 with discussion Force and Motion. The study conducted in the even semester in the academic year 2018/2019. The population in this study were all class IV students. The variables used in this study were the independent variables and the dependent variable. In this study, the independent variable was the learning model while the dependent variable was the problem-solving students' abilities.

This study used instruments in the form of a scientific literacy test that measured students' scientific literacy. AQ questionnaire as an instrument determined the student's fighting power when given pressure or problems, which contained 40 statements. In this study, the Science Literacy Test (TLS) was presented in the form of multiple-choice questions. TLS consists of 20 items created based on indicators of competency achievement.

The questionnaire instrument used to obtain data about the AQ characters owns by students. The questionnaire instrument was arranged based on three aspects which consist of: a) Quitter, b) Camper and c) Climber.

The results showed that of the force and motion material tests were carried out normality test, homogeneity test and average similarity test which were described as Normality test used to determine the data obtained in the normal distribution or not. To analyze normality used SPSS 19 with the Kolmogorov of Smirnov Test. Homogeneity test used to see the class that has been learning the PBL model aided by the performance assessment has the same variance or not.

To analyze varians similarities SPSS 19 with the Levene Statistical Test was used. The mean similarity test used to find out the similarity of students' scientific literacy in PBL model learning aided by performance assessment and students in control learning. To analyze the mean similarity test SPSS 22 by using the Independent Sample T-Test was used.

After pretests data is already calculated, posttest data results were used to test the hypothesis. Average difference test, N-gain test, and the Paired Sample T-Test, were used to compare the two-mean difference of two paired samples assuming normal distribution data.

RESULTS AND DISCUSSION

Based on the initial data, they are normality test, the homogeneity test, and the average similarity test. It is indicate that the classes taken as samples in the study were normally distributed and have homogeneous variances. It means that the sample comes from the same condition or condition that was having the same caractesties as in Table 1.

Table 1. Student Initial Data

Aspect	Experiment class	Control class
Number of Students	30	30
Average score	57.83	55.83
Score Maximum	75	75
Score Minimum	40	40
Standard deviation	9.067	9.010

The early scientific literacy data of the two classes were taken from the results of tests of force and motion material. Based on the test results, the average score at IVA grade students of SDN 1 Purwawinangun experimental class was 57.83 while the control class was 55.83. Both classes used as research samples were after normality test, homogeneity test and average similarity test.

Data of research in the form of tests of scientific literacy ability were included 3 aspects, namely, knowing, applying and reasoning. Posttest data were analyzed by t-test to determine the effects of the PBL model aided by performance assessment on the ability of scientific literacy.

The mean score of students' scientific literacy abilities obtained by the experimental class (48.47) through the application of the PBL model assisted by the performance assessment. It higher than the score of the control class (26.95) which used the PBL model only. This was thought to be because learning by PBL models assisted by performance assessments trained and optimized the ability of scientific literacy in the material style and motion those aspects were knowing, applying and reasoning.

The results of the control class's scientific literacy ability with the experimental class in each aspect were presented in Table 2.

Table 3. The Results Percentage of Student Science Literacy

Class	Categorys		
	Knowing	Applying	Reasoning
Experiment	45	30	15
Control	30	20	15

a. *Knowing Aspect*

Based on Table 2, it can be seen the percentage of knowing ability that included recall/recognize, define, describe, illustrate on example, and students' used were tools and procedures in the experimental class were higher than that of the control class. This fact was allegedly due to the syntax of the first and second stages of PBL conducted in the experimental class, which provided orientation on problems to students and conducted several experiments on core learning for students' learn.

b. *Applying Aspect*

Based on Table 3, it can be seen that the percentage of the ability was explained to apply in the experimental class is higher than that of the control class. This was supported by the second and third syntax of PBL, which were organized by the students to learn and helping independent and group investigations.

c. *Reasoning aspect*

In Table 3, it can be seen the percentage of students' reasoning aspects in the experimental class was higher that of than the control class. The high aspect of reasoning in the experimental class compared to the control class was supported by learning on using PBL assisted by the experimental class in the third, fourth, and fifth stages.

Giving AQ questionnaire to the experimental class aimed to classify students based on it. Student groups were the AQ obtained that used as consideration in science literacy. The results of the AQ questionnaire at class IV A SDN 1 Purwawinangun look at in detail in Table 4.

Giving AQ questionnaire to the experimental class aims to classify students based on AQ. Student groups based on the AQ that has been obtained will be used as consideration in science literacy. The results of the AQ questionnaire in class IV A SDN 1 Purwawinangun can be seen in detail in Table 4.

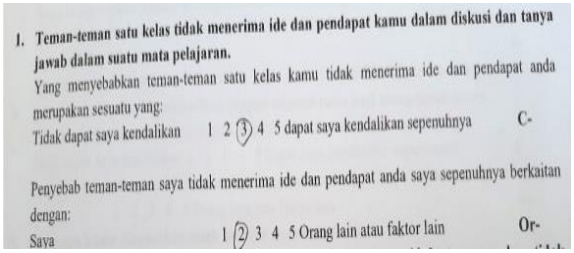
Tabel 4. The Results of AQ Students.

Quitter	Camper	Climber
2	18	10

Each AQ category was taken by 2 student representatives to analyze their scientific literacy abilities. the research data referred in this study were AQ data and data on students' scientific literacy abilities in the subject matter of force and motion. Student AQ data was viewed for using a questionnaire that validated by an expert validator.

Students with the camper category are far better at dealing with problems given the teacher proven in working on scientific literacy problems able to get a good score. students in the category of climber are said to be facing problems and

students in the category of quitters are less and are still afraid in facing problems given by the teacher as in figure 1a student result of quitter, 1b student result of camper, 1 c student result of climber.


1. **Teman-teman satu kelas tidak menerima ide dan pendapat kamu dalam diskusi dan tanya jawab dalam suatu mata pelajaran.**
Yang menyebabkan teman-teman satu kelas kamu tidak menerima ide dan pendapat anda merupakan sesuatu yang:
Tidak dapat saya kendalikan 1 2 (3) 4 5 dapat saya kendalikan sepenuhnya C-

Penyebab teman-teman saya tidak menerima ide dan pendapat anda saya sepenuhnya berkaitan dengan:
Saya 1 (2) 3 4 5 Orang lain atau faktor lain Or-

Figure 1. student result of Quitter

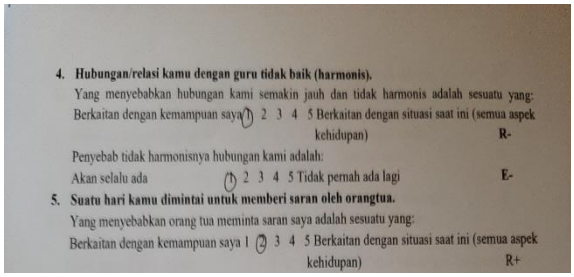

4. **Hubungan/relasi kamu dengan guru tidak baik (harmonis).**
Yang menyebabkan hubungan kami semakin jauh dan tidak harmonis adalah sesuatu yang:
Berkaitan dengan kemampuan saya (1) 2 3 4 5 Berkaitan dengan situasi saat ini (semua aspek kehidupan) R-
Penyebab tidak harmonisnya hubungan kami adalah:
Akan selalu ada (1) 2 3 4 5 Tidak pernah ada lagi E-
5. **Suatu hari kamu dimintai untuk memberi saran oleh orangtua.**
Yang menyebabkan orang tua meminta saran saya adalah sesuatu yang:
Berkaitan dengan kemampuan saya 1 (2) 3 4 5 Berkaitan dengan situasi saat ini (semua aspek kehidupan) R+

Figure 1b. student result of Camper

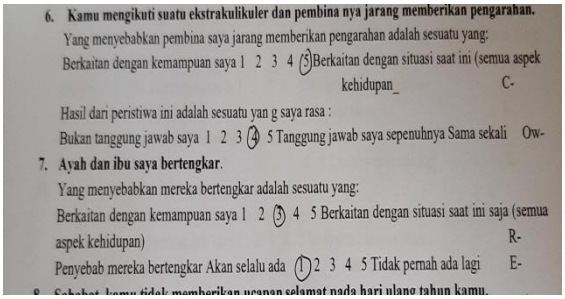

6. **Kamu mengikuti suatu ekstrakulikuler dan pembina nya jarang memberikan pengarahan.**
Yang menyebabkan pembina saya jarang memberikan pengarahan adalah sesuatu yang:
Berkaitan dengan kemampuan saya 1 2 3 4 (5) Berkaitan dengan situasi saat ini (semua aspek kehidupan_ C-
Hasil dari peristiwa ini adalah sesuatu yan g saya rasa :
Bukan tanggung jawab saya 1 2 3 (4) 5 Tanggung jawab saya sepenuhnya Sama sekali Ow-
7. **Ayah dan ibu saya bertengkar.**
Yang menyebabkan mereka bertengkar adalah sesuatu yang:
Berkaitan dengan kemampuan saya 1 2 (3) 4 5 Berkaitan dengan situasi saat ini saja (semua aspek kehidupan) R-
Penyebab mereka bertengkar Akan selalu ada (1) 2 3 4 5 Tidak pernah ada lagi E-

Figure 1c. student result of Climber.

CONCLUSION

The effectiveness of learning was assessed from two components, namely: science literacy and student adversity quotient. The scientific literacy ability of students by PBL learning assisted by performance assessment was better than that of the scientific literacy ability of students by PBL learning only. Aspect analysis of adversity quotient on the ability of scientific literacy was a good those were quitter, camper, and climber.

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