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The Influence of Science Comic Based Character Education on Understanding the Concept and Students' Environmental Caring Attitude on Global Warming Material

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Abstract

Problem-solving skills related to socio-science issues in society'enviroment need to be owned by students. This ability can be trained with PBL (*Problem Based Learning*) model. The purpose of this research is to analyze problem solving abilities of students. The type of research *quasi experiment* with *one group pretest-posttest design*. X grade students from SMA N 1 Semarang and SMA Ksatrian 1 Semarang were used as research sample. The result consisted of primary outcome in the form of capability, N-gain value and classical content mastering as well as secondary outcome covering the implementation of learning, teacher's response and student's response. Based on the result, the average of problem solving ability SMA N 1 Semarang increased from 70% to 79,5%, while SMA Ksatrian 1 Semarang increased from 59,5% to 73%. Completeness of classical learning SMA N 1 Semarang, class X MIPA 7, 97% and class X MIPA 9, 79%. The completeness of classical learning SMA Ksatrian 1 Semarang, class X MIPA 3, 80% and class X MIPA 5, 65%. N-gain value of SMA N 1 Semarang 0,553 and SMA Ksatrian 1 Semarang 0,433 in medium category. The conclusion of this research is the utilization of social issue with PBL model can improve problem solving ability on ecosystem'learning in SMA.

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INTRODUCTION

21st century learning prepare nowdays generation to have special competence that required , it is "The 4Cs" includes creativity and innovation, critical thinking and problem solving, communication, and collaboration *(*Partnership for 21st,2007). Education in Indonesia should be able to push students having the necessary skills in this 21st century, like the ability of creativity and innovation, critical thinking and problem solving, communication and collaboration.

Education process in the National Education System in Indonesia is regulated, by the Law No. 20 ,2003. Article 3 of Law No. 20 of 2003 affirms that educational function should be able to improve the skills, creativity, independence, and responsibility. This criteria can be achieved by improving the quality of education in Indonesia. One of the government's efforts in improving the national education system is improving the curriculum periodically.

The curriculum applied in Indonesia in 2018 is the revised 2013 curriculum. Learning in 2013 Curriculum aims to prepare Indonesian to having the ability to survive as individuals and citizens who believe, productive, creative, innovative, and able to contribute to the life of society, nation, state and civilization of the world. The 2013 curriculum expects graduates to have four competencies, there are (1) spiritual attitude competence, (2) social attitudes, (3) knowledge, and (4) skills (Kemdikbud, 2016a). To fulfil the knowledge competencies in the 2013 Curriculum, students need to be encouraged to working on problems solving. Kemendibud (2013) confirmed that the 2013 curriculum aims to develop the potential of students to thinking about social problems solving in society. Problem solving abilities includes problem-solving skills that need to be trained to students during the learning process.

Problem-solving skills need to be possessed by high school students during the learning process, because this ability train students to identify problems, provide alternative solutions to problems that occur in the environment and society and make right, accurate, systematic, logical, and multifaceted decisions. Mukhopadhyay (2013) reveals that problem-solving ability is the ability to be trained in the learning process. The issues discussed should be closely related to daily life. One of the issues that should be raised in the learning process is the social issues that occur in the environment and society.

Social issues that occur in the environment and society can be used as a source of learning, especially on biology learning. Utilization of social issues is a strategy that aims to stimulate intellectual, moral and ethical development and social awareness of the relationship between science and social life (Zeidler *et al*., 2009). Strategies for the utilization of relevant social issues are taught in biology learning. Biology is part of Natural Science that includes knowledge, investigation / exploration process, and value. In addition, biology is closely related to daily life The results of Saad's research (2017) show that the utilization of social issues is taught in biology learning is relevant, because in the learning process students improve their problem-solving skills, find solutions to existing problems and address issues that occur in the environment and society.

One of the biology topics in high school related to the phenomenon of life is the ecosystem. To understand ecosystem material well, it is necessary to apply the learning process that not only gives the students an opportunity to understand the content of the ecosystem material, but the students are also able to apply the knowledge them and relate it to the problems occurring in the environment and society. Thus, the learning process in school will impact on student life. Learning's model that can be used social issue is problem based learning (PBL).

Problem Based Learning (*PBL*) is a learning's model that utilizes real problems as the first step in integrating new knowledge and practicing problem solving skills as the main goal of the learning process. Arend (2008: 397) revealed that PBL is one of the learning models designed to help students develop their thinking skills, problem solving and intellectual skills. The results of Sahyar and Fitri (2017) show that PBL is a learning model that improve student problem solving abilities.

RESEARCH METHOD

The research conducted in SMA N 1 Semarang and SMA Ksatrian 1 Semarang. The design of research quasi experimental with one group pretest-posttest design was used in this study. X grade students from SMA N 1 Semarang and SMA Ksatrian 1 Semarang were used as research subjects. Determination of research subjects using purposive sampling technique. The independent variable is the application of PBL to the learning ecosystem of X grade . The dependent variable is the problem solving ability. The control variables are biology teacher, biology material, number of lessons and *pre-test* and *post-test*. The research data is divided into two primary data such as problem solving skills, N-gain and completeness of classical learning as well as secondary data are learning implementation with descriptive percentage analysis (guttman scale), teacher's response with qualitative descriptive analysis (interview) , student's responses with descriptive percentage analysis (linkert scale)**.**

RESULT AND DISCUSSION

The results of this research conducted at SMA N 1 Semarang and SMA Ksatrian 1 Semarang include primary data with the value of problem solving ability and secondary data such as learning execution, teacher responses and student responses to the utilization of social issues with PBL model to improve problem solving skills on ecosystem's learning in SMA N 1 Semarang and SMA Ksatrian 1 Semarang.

Research of Problem Solving Ability

Students' problem solving abilities data obtained from pretest and posttest values are presented in Table 1. Based on the results, it can be seen that the average of pretest score in SMA N 1 Semarang X grade MIPA 7 is 69 and post–test value is 80, while X grade MIPA 9 average pre-test value is 71 and post-test value ia 79. The average pre-test value SMA Ksatrian 1 Semarang X grade MIPA 3 is 59 and average post-test is 74. X grade MIPA 5 from SMA Ksatrian 1 Semarang pre-test average value is 60 and the average post-test is 72. Based on the value of pre-test and post-test, the percentage of problem-solving ability to solve the problem is find. SMA N 1 Semarang and SMA Ksatrian 1 Semarang have increased percentage of problem solving ability. The percentage of problem solving ability of X grade MIPA 7 increased from 69% to 80%, X grade MIPA 9 increased percentage of problem solving ability from 71% to 79%, X grade MIPA 3 increased from 59% to 74% , and for X grade MIPA 5 also increased from 60% to 72%.

In addition to improve the results of problem-solving skills also can be seen from the completeness of classical learning. Based on the completion percentage of classical learning from SMA N 1 Semarang increase from pre-test to post-test. The percentage of classical learning completeness of X grade MIPA 7 increase from 59% to 97% with optimal final criteria and X grade MIPA 9 SMA Ksatrian 1 Semarang also increase for 71% to 79% with optimal final criteria. The results for the complete percentage of classical learning from SMA Ksatrian 1 Semarang also increased from pre-test to post-test. The result of classical completion for X grade MIPA 3 by 30% to 80% with optimal final criteria and for the completion percentage of classical learning result for X grade MIPA 5 increase from 26% to 65% with final criteria not optimal yet. Based on the results can be seen that the completion of the final classical learning in SMA N 1 Semarang has reached the optimal criteria because the percentage of classical learning completeness ≥75% and for X grade MIPA 5 SMA Ksatrian 1 Semarang has not reached the optimal criteria because the percentage of learning completeness klasikal ≤75 %.

According to the analysis results during the learning progresses, factors that may affect the completion of classical study is not optimal yet, because the application of PBL models with the discussions are not accustomed to do. Students of SMA N 1 Semarang often used PBL involving students to discuss, express opinions and solve problems, whereas in SMA Ksatrian 1 Semarang PBL model with discussion has never been applied so that students are not accustomed to express their opinions and solve problems. In addition to these factors, the lack of seriousness of the students in learning and some of students who because there was extra-curricular at the learning time effect the pre-test and post-test result less than the maximum in doing it.

The following results of problem-solving ability in Table 1. The improvement of problem-solving ability based on N-gain analysis can be seen in Table 2.

Tabel 1 Table 1. Results of problem solving ability before and after learning by utilizing social issue with PBL of ecosystem material in SMA N 1 Semarang and SMA Ksatrian 1 Semarang.

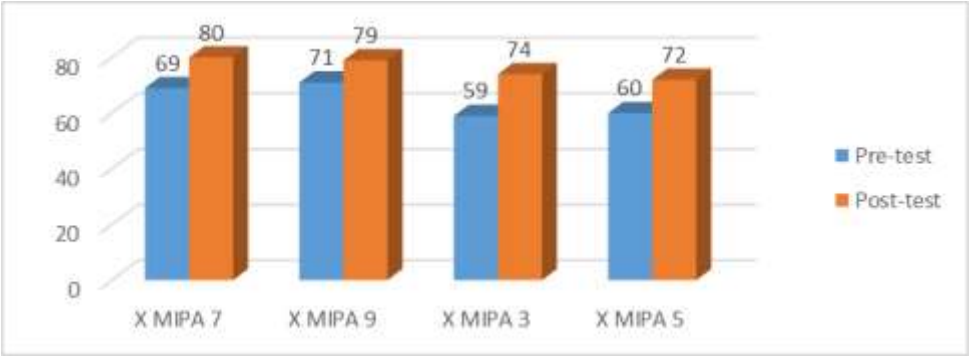
Learning Outcomes	SMA N 1 Semarang		SMA Ksatrian 1 Semarang	
	X MIPA 7	X MIPA 9	X MIPA 3	X MIPA 5
Number of Students	34	34	30	31
Average pre-test score	69	71	59	60
Average post-test score	80	79	74	72
Initial Problem Solving Ability (%)	69	71	59	60
Final Problem Solving Ability (%)	80	79	74	72
Precision of classical pre-test (%)	59	71	30	26
Completion of classical post-test (%)	97	79	80	65
Average initial probel solving ability (%)	70		59,5	
Average final problem solving ability (%)	79,5		73	

K : Ability

Tabel 2 Initial and Final Problem Solving Abilities at SMA N 1 Semarang and SMA Ksatrian 1 Semarang based on N-gain analysis.

Results	SMA N 1 Semarang		SMA Ksatrian 1 Semarang	
	X MIPA 7	X MIPA 9	X MIPA 3	X MIPA 5
Initial Problem Solving Ability (%)	69	71	59	60
Final Problem Solving Ability (%)	80	79	74	72
N-gain	0,406	0,295	0,516	0,351
Category	Medium	Low	Medium	Medium
Average N-gain	0,553		0,433	
Category	Medium		Medium	

The increase of percentage of problem solving ability (Table 2) shows the average of N-gain in SMA N 1 Semarang X grade MIPA 7 is 0.406 with medium category and 0,295 for X grade MIPA 9 with low category. The result of N-gain SMA Ksatrian 1 Semarang X grade MIPA 3 of 0,516 and 0,351 for X grade MIPA 5 with medium category. The average N-gain of SMA N 1 Semarang is 0,553 and SMA Ksatrian 1 Semarang is 0,433. Thus, the difference between the pre-test and post-test score describes the problem solving ability shows a considerable increase, except X grade MIPA 9 because the pre-test result data is well so increasing problem solving ability is not significant. Problem solving abilities improvement in SMA N 1 Semarang and SMA Ksatrian 1 Semarang can be seen in Graphic 1.



Grafic 1 Ability Problem Solving SMA N 1 Semarang and SMA Ksatrian 1 Semarang

In general, the N-gain value of both schools has reached the moderate category because there is an increase in the value of pre-test and post-test, so it can be said that the utilization of social issues in learning ecosystem with PBL model improve student problem solving ability. As Kusumaningtyas *et al.* (2013) reveal there is a learning model with significant effect to problem solving ability and student cognitive learning result. Students who are taught using the PBL model have higher problem-solving ability and cognitive learning outcomes than conventional teaching students.

The pre-test and post-test questions used in learning are the multiple-choice questions of the story by utilizing the social issues that exist in the environment and society, requiring students to analyze, understand, provide solutions to the problems presented and evaluate. Students who feel rushed to work on the problem because they do not like to read, students who are not accustomed to analyze real problems and the time of the problem is limited are of the learning obstacles encountered.

Implementing of Learning

Based on the observations made and data that have been analyzed, the implementation of learning by utilizing social issues to improve problem-solving skills on learning ecosystem material in high school is included in the very high category. This can be seen in Table 3. The percentage in SMA N 1 Semarang X grade MIPA 7 is 95.6% and X grade MIPA 9 is 93.4%, while the percentage in SMA Ksatrian 1 Semarang X grade MIPA 3 is 93.4% and X grade MIPA 5 is also 93.4%. In this lesson, the teacher almost performs all observed aspects of the observer. Based on Table 4. it can be seen that the 15 aspects of the implementation of learning have been in very high and high criteria. The average of learning activity in each school, SMA N 1 Semarang is 94,5% and SMA Ksatrian 1 Semarang is 93,4%. The percentage of learning activities in both schools is very high. The results of learning implementation data in Table 3.

Tabel 3 Results of data learning implementation in SMA N 1 Semarang and SMA Ksatrian 1 Semarang

School	X grade	Learning Performance	Criteria
SMA N 1 Semarang	MIPA 7	95.6%	Very High
	MIPA 9	93.4%	Very High
SMA 1 Ksatrian	MIPA 3	93.4%	Very High
	MIPA 5	93.4%	Very High

More detailed data from each indicator in the observation sheet of the implementation of the learning of the two schools is presented in Table 4.

Table 4 The analysis result of each indicator in the observation sheet of the learning implementation of X grade at SMA N 1 Semarang and SMA Ksatrian 1 Semarang

No	Teaching Implementation of X grade	SMA N 1 Semarang (%)		SMA Ksatrian 1 Semarang (%)		Average (%)	Criteria
		MIPA 7	MIPA 9	MIPA 3	MIPA 5		
1	RPP using social issue	100	100	100	100	100	ST
2	Providing apersepsi	100	100	100	100	100	ST
3	Giving Pre-test /Post-test	67	67	67	67	67	T
4	Directing students' attention on social issues	100	100	100	100	100	ST
5	Motivating students	100	100	100	100	100	ST
6	Learning is tied by real life	100	100	100	100	100	ST
7	Fun learning environment	100	100	100	100	100	ST
8	Learning steps according RPP	67	67	67	67	67	T
9	Using that correspond media	100	100	100	100	100	ST
10	Guiding students discussion, looking for data, and solve problems	100	67	100	100	92	ST
11	Ask questions in learning	100	100	100	100	100	ST
12	Respond to student questions	100	100	67	100	92	ST
13	Conclusions by teachers with students	100	100	100	100	100	ST
14	Deliver material for next meeting by theacher	100	100	100	67	92	ST
15	Closing lessons	100	100	100	100	100	ST
Class averages		95.6	93.4	93.4	93.4	94	ST
Average of each school		94.5		93.4			ST

Description:
ST: Very High
Q : High

In the third indicator that is giving pretest / posttest, each class does not get 100% percentage because no pre-test / post-test in the second meeting. Pre-test / post-test is only done at the first and third meeting. In the eighth indicator of the learning steps in accordance with the RPP each class didn't get average and percentage was 100% because no accordance with the RPP at the third meeting and there was a reduction of lessons from the school that made showing video carbon cycle to students is canceled. In the tenth indicator in X grade Mipa 9 has a percentage less than 100% because there was one group according to the observer lack of teacher guidance in the discussion. In the 14th indicator X grade Mipa 5 did not get 100% percentage causes no information for next meeting are the learning time had been end so the teacher has not had time to provide information about the upcoming meeting. Based on the results, it can be concluded that the implementation of learning by utilization of social issues with the PBL on the learning of ecosystem material had been implemented well to improve students' ability in solving the problem.

In learning the utilization of social issues with this PBL model there was some obstacles, such as reduction time of the lesson due agenda of the school, holidays of red dates, and had more attention to conditioned the students because the class is wide enought. For that teachers are required to have the readiness and good skills so that learning goes well.

Teacher Response

Based on Table 5. teacher response data on social issue utilization with PBL model to improve problem solving ability on learning ecosystem material can be known that biology teacher of SMA 1 Semarang and SMA Ksatrian 1 Semarang given positive response to the learning that had been implemented.

Table 5 Quotation of interviews with SMA N 1 Semarang teacher and SMA Ksatrian 1 Semarang teacher on learning

No	Interview	Teachers	
		SMA N 1 Semarang	**SMA Ksatrian 1 Semarang**
1	Response to the implementation of the PBL by utilizing social issues to the ability problem-solving	Relevant with 2013 curriculum revision and stimulate the reasoning students solving ecosystem issues	Gives students opportunities to think so indirectly improve problem-solving skills
2	Effectiveness of PBL implementation by utilizing social issues on ecosystem learning	Effective because students directly see the real events to solve ecosystem problems	Effective because it stimulates students to solve problems in the existing cases as well as increasing the courage of students argue
3	Application of PBL with social issues improving problem solving ability	Significant impact on problem solving ability seen from the increase of the percentage of students who reach value above KKM influence	Influence positivein improving problem solving ability seen from increasing of result *pre-test* and *post-test* activity of student every meeting.
4	Learning student motivation on application	Students are more enthusiastic and eager because they can argue to solve problems	Students are motivated seen from the eager in expressing the argueing ability to solve problems
5	Suggestions / criticism	Better if collaborated with the project as a result of student work (mini project such as proposal / draft research)	It is better to add the case given during the learning so that the problem solving ability of students more honed

Based on the results of interviews with SMA N 1 Semarang teacher said that the learning used was relevant learning according to the needs of the 2013 revision curriculum that stimulates the reasoning of students to more actively solving global issues related to the ecosystem. In addition, the learning provided also includes effective learning because it can shown see the real events related to ecosystem problems resulting in increasing problem solving ability, increasing motivations to learn seen like students who are more enthusiastic and eager in learning.

Based on the interview result of SMA Ksatrian 1 Semarang teacher, the lesson used is good learning because it increased students' activeness to argue, students problem solving ability and student motivation to learn. Based on teacher response data from both schools, it can be concluded that the utilization of social issue with PBL model can improve problem solving ability in learning ecosystem material. It can be seen that the biology teacher in SMA N 1 Semarang and SMA Ksatrian 1 Semarang provide a positive response to the learning that had been implemented. It was very helpful for students to understand the material ecosystem. As revealed by Kemendikbud (2013) that PBL has several advantages, such as meaningful learning, stimulate students to learn, integrate knowledge and skills simultaneously apply relevant content, improve problem solving ability.

Student Response

Based on the score of students' responses to the utilization of social issues with the PBL model to improve problem solving ability on the learning of ecosystem materials in SMA N 1 Semarang is 77.8% in good category obtained from the percentage of students' responses in grade X MIPA 7 of 79.2% and X grade MIPA 9 is 76, 5%. Data result of student responses SMA Ksatrian 1 Semarang with average 76,2% in good category obtained from percentage of X grade MIPA 3 equal to 74,8% and X grade MIPA 5 equal to 78,6%. This means that the use of social issues with the PBL model generally have a positive effect on improving students' problem solving ability in ecosystem learning at high school. In the learning applied social issues that develop in the environment and community and conduct discussions. The results of students response can be seen in Table 6.

Table 6 The results of the students responses of SMA N 1 Semarang and SMA Ksatrian 1 Semarang to the model of applied learning

School	X grade	Presentation Response Students	Criteria
SMA N 1 Semarang	MIPA 7	79.2%	Both
	MIPA 9	76.5%	Good
SMA 1 Ksatrian	MIPA 3	77.6%	Good
	MIPA 5	74.8%	Good

Questionnaire student feedback consists of fifteen indicators. The questionnaire indicator of student responses is described detail in Table 7. Based on the results of the students' responses in each indicator in Table 7.

Table 7 Indicators of SMA N 1 Semarang and SMA Ksatrian 1 Semarang responses.

No	Response Students X grade	SMA N 1 Semarang (%)		SMA Ksatrian 1 Semarang (%)		Average (%)	Criteria
		MIPA7	MIPA 9	MIPA 3	MIPA 5		
1	Interest following learning	79	76	81	76	78	Good
2	Level of problem solving ability	75	74	71	71	72.75	Good
3	Constraints follow learning	71	64	66	70	67.75	Good
4	Learning motivation	74	75	78	75	75,5	Good
5	Classroom atmosphere	76	80	80	74	77,5	Good
6	Effectiveness of social issue utilization	83	79	81	78	80.25	Very good
7	Courage opinion	79	76	79	73	76.75	Good
8	Understanding with PBL model	77	75	78	75	76.25	Good
9	Variation of learning resources	85	85	80	81	82.75	Very good
10	Defining problem	79	76	78	73	76 , 5	Good
11	Exploring problems	82	76	78	74	77,5	Good
12	Planning solutions	82	77	79	73	77.75	Good
13	Choosing the right solution tips	83	77	76	79	78.75	Good
14	Evaluating the problem	81	79	82	74	79	Good
15	Solving problem	82	79	78	77	79	Good
Average every grade		79.2	76.5	77.6	74.8	78.6	
Average of every school		77.8		76.2			

The results show that the mean percentage of each indicator of student responses to the utilization of social issues with the PBL model in the learning of this ecosystem material is good in either category except indicator the effectiveness of learning and the variation of learning resources into high score with very good criteria. It shows that based on students' responses in learning by utilizing social issues with PBL in the ecosystem material is effectively applied to students because it can improve problem-solving ability and can provide variations of learning resources with of problems or social issues that exist around the environment and society. This is reinforced by the research of Gunantara *et al*. (2014) which states that learning is much more effective through PBL.

The conclusion of the students 'responses to the utilization of social issues in learning with the PBL model on the learning of this ecosystem material are attracting students to learn, increasing students' motivation to learn, students feel more enthusiastically follow the lesson, improving courage of opinion and the problem solving ability of students include identifying problem , exploring problems, planning solutions, tips on implementing one of the right solutions and evaluating.

CONCLUSSION

Based on the analysis of research data and discussion, it can be concluded that the utilization of social issues in PBL improve problem solving abilities of high school students in ecosystem material. Problem solving abilities in state high school, SMA N 1 Semarang and private

high school, SMA Ksatrian 1 Semarang increase seen from the value of N-gain. The N-gain value of SMA N 1 Semarang is 0.553, while SMA Ksatrian 1 Semarang is 0.433 in medium category.

REFRENCES

Arends, R. I. 2012. *Learning to Teach (9th.Ed)*. Boston: McGraw-Hill.

Kemendikbud. 2013. *Permendikbud No. 69 Tahun 2013 Tentang Kerangka Dasar dan Struktur Kurikulum Sekolah Menengah Atas/ Madrasah Aliyah*. Jakarta:Kementerian Pendidikan dan Kebudayaan.

Kemendikbud. 2016a. *Permendikbud No 24 Tahun 2016 Tentang KI dan KD Lampiran 7*. Jakarta: Kementerian Pendidikan dan Kebudayaan.

Kusumaningtias, A., S. Zubaidah, S. E. Indriwati. 2013. Pengaruh Problem Based Learning Dipadu Strategi Numbered Heads Together terhadap Kemampuan Metakognitif, Berpikir Kritis, dan Kognitif Biologi. *Jurnal Penelitian Kependidikan.* 1(1):33-47.

Mukhopadhyay, D. R. 2013. Problem Solving in Science Learning–Some Important Considerations of a Teacher. *IQSR Journal of Humanities and Social Science.* 8(6):21-25.

Partnership for 21st Century Skills (P21). 2007. *Framework for 21st Century Learning.* Retrieved from P21 Partnership for 21st Century Skills: http://www.p21.org/our-work/p21-framework [diakses 10-1-2018].

Saad, M. I. M., S. Baharom & S. E. Mokhsein. 2017. Scientific Reasoning Skills Based on Socio-Scientific Issues in The Biology Subject. *International Journal of Advanced and Applied Sciences*. 4(3): 13-18.

Sahyar & R.Y. Fitri. 2017. The Effect of Problem-Based Learning Model (PBL) and Adversity Quotient (AQ) on Problem-Solving Ability. *American Journal of Education Research*. 5(2): 179-183.

Zeidler, D. L., T. D. Sadler, S. Applebaum, & B. E. Callahan. 2009. *Advancing Reflective Judgment Through Socioscientific Issues. Journal Of Research In Science Teacing*. 46 (1): 74-101.