The Effect of Problem Based Learning for Student's Environmental Literacy

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Abstract—**This study has the purpose to identify the effect of problem based learning (PBL) in enhancing student's environmental literacy. This research used quasi experimental design. It involved 50 students from first grade of 10th state senior high school of Semarang. The Students in experimental class was taught by problem based learning model while in control class was taught by conventional model. Data collected in this research was students environmental literacy who collected by middle school environmental literacy survey (MSELS). MSELS instrument first validity by rash analysis. The data gathered then analyzed using covariate analysis (ANCOVA). The result of this study showed that there are differences between PBL class and conventional class in enhancing student's environmental literacy with significant value as 0.002. This result indicated that PBL model could strength student's environmental literacy well.**

Keywords— problem based learning, environmental literacy

I. INTRODUCTION

Indonesia was a country with a lot of coastal areas. This condition gave many benefit to this country related to the diversity. It provided potential natural resources and land with complex used [1]. But, in recent years, there were environmental issues that disrupt coastal area in high level damage. Most of them occurred in coastal area. It also happened in central java. A problem such as aberration was happened in wide range area across districts in central java [2]. It is about 5000 ha of area that was in damage because of aberration. This problem would lead to many problems. Aberration was condition in decreasing soil level. In addition with increasing of sea level, the sea water will flow to the land. The land itself could not absorb that water. Then it caused some flood. This problem affected many sectors in human living. As for economical view, flood would affect commerce. Any seller and buyer had difficulty to perform trading activity directly in this condition. Flood and aberration also demolished the transportation system. Public transportations such as bus, train, taxy, and even private vehicles could not be operated in flooded route. Furthermore, flood affected human health. It drove a lot of disease vector to develop rapidly. In some case a certain disease such as malaria, diarrhea, and cholera were frequently found in that area.

The damage of coastal area was strongly related to human behavior. Many people over used natural resources without even tried to regenerate it. They used coastal land to build factory, harbor, farmland, mall, and also coast reclamation that worsen the land condition. This activity led to mangrove logging in order to open the mangrove for building. Many life of organisms inhabit mangrove were disrupted. The animal and plant diversity would decrease gradually in that area. In addition, local people often pollute the coastal area with household garbage, plastics, organic, and inorganic waste. In certain area, there are many factories that flow the chemical waste in to the beach. Furthermore, the waste will contaminate sea water by toxic materials that poisoned the organism living in.

This problem mostly caused by the people that threat environment badly. It strongly related to people education and how they got environmental literacy in the school. In fact, the education condition in the northern coastal area is low, it found that the education of the majority of household heads did not complete primary school and a few graduated from junior high school [3]. This implies that the condition of schools on the north coastal is less able to give positive influence in society. Basically, the practice of learning done in north coastal schools is similar to other schools, but there are some things that need to be improved both in terms of facilities and infrastructure, curriculum implementation, skill level and professionalism of educators, as well as the capacity of the community. Schools in the northern coastal areas do have many obstacles to develop like schools in other big cities. In addition to environmental conditions such as aberration and rising sea water, people also have a low awareness of the importance of education and environmental sustainability. Many people who work as fishermen and children tend to follow the sea from the school, in addition to the lack of motivation or encouragement of parents to their children back to school [4],[5]. This is a very difficult task for schools because it must be able to change the mindset of the community associated with the level of education and environmental conservation in coastal areas.

Many people were lack of educational background about environment. As it seen in Semarang, there were any report that showed how poor the students environmental literacy. Most of them were categorized in mid-low level environmental literacy. This condition needed serious attention to every stakeholder in educational field. In the

national curriculum document, environmental topic was learned by students in first grade at second semester. The fact that environment topic was taught but the student's environmental literacy was quite low. It assumed that mostly students only focus on cognitive skill. They know well how the importance of environment in life but they lack of attitude and behavior toward it. Furthermore, the learning process couldn't accommodate students need about environmental issues. Students mostly learned about the ecology but rarely observe ecological issues around them. They not familiar with issues related to the environment and didn't think to solve it. So, learning process must be adapted to innovative learning process that promoted students higher cognitive skills along with their attitude and behavior.

Innovative learning model was needed to promote students skill toward environmental issues, especially in environmental literacy. So, the learning model that contained activity in problem solving must be one of the solutions. One of learning model that suited to this was problem based learning (PBL) model. PBL was students-centered learning process that empowered learners with research simulation, integrated theory and practice, and also developed skills and knowledge related to problem solution [6]. PBL could help students to develop their thinking skills and problem solving skills. In PBL class, students made a plan, hypothesis, and giving argument to solve the problem given. This activity involves logical and critical analysis thinking, the using of analogy and also integrated creativity. There were some reports that PBL could promote students process skills and conceptual skills in ecological term [7], [8], [9]. PBL was also promoted pedagogy and learning process, stimulate essential thinking and the construction of knowledge [10],[11]. PBL model contain some syntax that purposely enhance learners problem solving skill [12]. If it combined with environmental subject, student's literacy in environmental issue will be developed.

II. METHOD

This research used quasi experiment with *Pretest-posttest Nonequivalent Control Group Design* [13](table 1). The research used random sampling. It involved 25 senior high school students both in control and experimental class. The students in experimental class were taught by problem based learning model while control class was discussion and presentation (conventional model).

Table 1. *Pretest-posttest Nonequivalent Control Group Design*

Group	Pretest		Postes
Experiment	O_1	X_1 (PBL)	O_2
control	O_3	X_2 (conventional)	O_4

The independent variable in this study was environmental literacy comprehension. This variable was measured by *middle school environmental literacy survey* (MSELS) with certain modification related to real issues in local coastal area [14]. MSELS questionnaire contains of 64 questions and divided into 7 indicators including ecological knowledge, issues identification, issues analysis, personal attitude to environment, willingness to act, verbal commitments, and actual commitments. Those students answer in pretest and posttest then scored and analyzed using covariate analysis (ANACOVA). Before that, the data was analyzed by normality test.

III. RESULT AND DISCUSSION

The PBL class and conventional class showed different result in student's performance of environmental literacy. The result of student's environmental literacy in PBL and control class is given in table 1. From this result, it was seen that all of environmental literacy indicator in PBL class was higher than conventional class as general. The only exception was in environmental emotion aspect that showed higher mean score in conventional class as 93.60 in pretest and 94.40 in posttest. In contrast with conventional class, environmental emotion aspect in PBL class was decreased for 6 points from 95.20 in pretest became 89.20 in posttest. It contradicted with the term that cognitive are in the positive relationship with attitude. But this result has similar results Beech research that there was limited in one's emotion even though their cognitive skill was high [15]. That mean every rise in cognitive skill didn't represent the rise in emotion precisely. There must be any limited factor that influenced it.

The highest student's score was in environmental emotion indicator followed by actual commitment indicator. However, the lowest score of environmental literacy is issues identification. It showed 34.67 score in pretest and 28.00 in posttest for conventional class and 33.33 in pretest and 58.67 in posttest for PBL class. The other environmental literacy indicator such as ecological knowledge, issues analysis, verbal commitment, and environmental sensitivity had similar score in which those were above 50 point. Comparing pretest and posttest score in both PBL and conventional class, the students score of environmental literacy was vary. In conventional class, those score tend to decrease in every indicator except environmental emotion that increased 0.80 point from pretest to posttest. But in PBL class, the students score was increase from pretest to posttest except verbal commitment and environmental emotion indicator that decrease up to 6 point. Overall, both in PBL and conventional class showed adequate level of environmental literacy.

Identification of environmental issues became the hardest think to the students. Issue identification referred to the activity to understand what the main environmental issue given in the text. Students need to compare with the issue given with their prior knowledge to achieve a good comprehension regarding the issues. To better understand about issue identification, students need to improve their higher thinking skills. It required analysis and evaluating thinking. However it's quite hard for students to be achieved. This ability need to be practiced regularly. So it required best learning environment and instruction that force students to think in higher level. This ability is essential in problem solving activity. If students failed to understand the issues itself, they will have some difficulty to make further action in order to solve those issues. This condition implies that student was not aware about the environmental problem that already existed in the society.

Table 2. Score Of Student's Environmental Literacy In Pbl And Conventional Class

Item	Control				Experiment			
	Pretest		Posttest		Pretest		Posttest	
	Mean	Sd	Mean	Sd	Mean	Sd	Mean	Sd
Ecological knowledge	66.59	14.28	59.76	11.09	74.59	7.35	75.53	10.96
Issues identification	34.67	20.37	28.00	32.89	33.33	16.67	58.67	22.11
Issues analysis	65.33	19.20	56.67	30.05	44.00	21.45	60.00	19.25
Verbal commitment	73.27	9.17	71.87	8.21	76.80	7.02	70.40	7.75
Environmental sensitivity	62.33	9.02	61.89	7.49	61.02	10.73	63.56	10.74
Environmental emotion	93.60	11.14	94.40	6.51	95.20	5.86	89.20	15.25
Actual commitment	73.60	12.74	71.73	8.64	75.27	10.07	76.40	11.35

Table 3. Analysis Result Of Environmental Literacy Comparison In Pbl And Conventional Class

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	970.585[a]	2	485.292	7.551	.001
Intercept	942.788	1	942.788	14.670	.000
z	347.100	1	347.100	5.401	.024
x	708.162	1	708.162	11.019	.002
Error	3020.468	47	64.265		
Total	228480.296	50			
Corrected Total	3991.053	49			

The highest score of student's environmental literacy indicator is environmental emotion. This indicator was one part of attitude aspect toward the environment. In this term, most students showed their support to the environment. This result implies that students had a good attitude toward environment. It could be a good provision for students to learn and act for the environment, although it also important to strength the cognitive skill. The more cognitive skill approached, the more attitude and behavior could be achieved. Secondly, actual commitment became was high in student's environmental literacy. This aspect was related to student's plan to act toward environmental issue given. This result implies that students have good behavior to conserve the environment and prevent the disruption in their environment.

Further analysis was used in this study. The data then analyzed statistically using ANACOVA test. Before that, the data was tested by normality test and showed normal distribution. The result of ANACOVA test was given in table 2. The analysis result showed that the sig. value is 0.002. That's mean there are differences between PBL class and conventional class in affecting students environmental literacy when students PBL class showed better result than in conventional one. PBL contain some activity that led the student to solve the environmental problem. It encouraged students to engage in cognitive process to understand and make the best solution. It includes the willingness to engage with such situations in order to achieve one's potential as a constructive and reflective person. From this point, PBL class gave the chance to students to level up their cognitive skill trough the issue given as the core of the learning. In many research, PBL was reported to has the capability in rising students cognitive and learning achievement [16]. When performing PBL, student face issue related to environment then they made research and investigation about it. They acquired the scientific knowledge, retained it, and then applied it correctly regarding to the problem given. In additional, the students will realize the core of everything they have learned. They found the concept by themselves and used it in every context especially whose related to the environment.

PBL class has learning activity that consisted of problem orientation, organization of learners, group investigation, problem solving development, and evaluation of problem solving process. In the problem orientation, student was given by certain environmental issues that they should discuss about. From the beginning PBL provide students in issue identification and analysis. In this point, students will use their old ecological knowledge to make some hypothesis regarding to the issue. Furthermore, students organized their investigation plan in a group. In this group they did some research investigation to that environmental issue. This activity will force students to face the problem directly. They will observe the environmental issue directly. This point was very significant to grow student's attitude toward environment. When they see the disruption of the environment and realized that will affect human and other organism life, their feeling to the environment will rise. In addition, PBL was proven to be able to increase problem solving skill. It was highly recognizable that PBL stimulate student's skill in problem solving trough many ways. When the problem solving was good in ecological subject, it could be sure that their literacy in environmental topic was great too [17].

After investigation process, students will develop their problem solving, making analysis and evaluate their work result. This activity will make their problem solving perfect and valuable. As an ideal, their problem solving was not

only statement but also represented by action. Those action had possibility to make change in students behavior toward environment. If students gave some problem solving to the environmental issue and they did it, They will help the restoration of the environment and also help their habit to become pro-environment. All of the learning instruction in PBL class represent complete environmental literacy.

PBL class also provided students with good social teamwork. The students learn and work in a group. Each group will perform every task together. This condition allowed one students to make some discussion, asking opinion based on their knowledge and experience related to the state problem. One student told their thought to each other. The dialog was created. There were so many difference information would be gathered. Along with this difference, students will be motivated to seek more information from every resource [24]. In this situation, students will found assimilation and accommodation process. Assimilation refer to the acquired new information and accommodation was happened when old information and new information were met and being processed in mental thinking. All of this event will lead to enhance the students comprehension.

IV. CONCLUSION

The result of this research showed that there are differences between PBL class and conventional class in enhancing student's environmental literacy with significant value as 0.002. This result indicated that PBL model could strength student's environmental literacy well. Mostly the environmental literacy indicator was increase di PBL class except environmental emotion aspect. It dropped 6 point from pretest to posttest. The highest score of environmental literacy was in environmental emotion aspect, followed by actual commitment, ecological knowledge, verbal commitment, environmental sensitivity, issue analysis and the last was issue identification. Overall, the student's environmental literacy was categorized as mid-level.

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