




# Artikel 5

## Strengthening Water Cycle Literacy among Senior High School Students in East Java Province, Indonesia through the Applica...

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## Strengthening Water Cycle Literacy among Senior High School Students in East Java Province, Indonesia through the Application of the Conservation-Based Learning Model

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**Abstract:** Water cycle literacy attracts great attention to the observers of climate change. Local and global impacts of the water cycle threaten human life and damage the Earth. Education is expected to be able to provide a way out of this problem. A Conservation-Based Learning (CBL) model was employed to understand the water cycle literacy among students in three cities in East Java province, Indonesia. There were 6 (six) Senior High Schools with a total number of 396 students serving as the sample. Each school consisted of common classes and CBL classes. Water cycle literacy aspects included knowledge, values, cognitive behavior, and acting behavior. The data were analyzed using a descriptive quantitative, and qualitative approach. The data were analyzed using a descriptive quantitative, and qualitative approach. The literacy aspect of values, attitudes, thinking, and acting skills in the water cycle in the CDL class is higher than that of the common class. Learning the water cycle using the CBL model gave significant effects on the students' strengthening of water cycle literacy (sig. 0.5).

**Keywords:** water cycle literacy, conservation-based learning model, knowledge, value, attitude, behavior.

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## INTRODUCTION

Scientists agree that climate change is closely related to water cycle. Any disturbance to the water cycle will give impacts on almost all life system in the Earth. The temperature of the earth surface in average increases around 0.6°C in the last century, and it is predicted to rise 1.8-6.6°C in the next 100 years. Such a small change in average temperature may seem insignificant, but many natural processes have been greatly influenced, including the water cycle. Global warming intensifies water movements through a cycle of which its process depends on temperature (NOAA, 2019).

Experts predict that Indonesia will encounter fresh water scarcity in 2025 (Royyani, H. 2017). Such water scarcity will absolutely also be experienced by more than 40% of the earth's population (Royyani, H. 2017). Even, the problem in fulfilling the need for water will occur in all countries (Al-Ansari et al., 2014). The United Nation reminds that water scarcity will influence the agricultural system and the fulfillment of staple foods (UNDP, 2007). This problem will also impact global food crises and starvation. The objective of reducing starvation and poverty in the world is hindered by climate change, water and energy crises (Qureshi, 2010). The impacts of climate change have altered the pattern of rain and this may result in various natural disasters such as floods and drought (Poudel et al., 2017).

16 Environmental changes, including climate changes, will influence the demand for the people's awareness of and responsibility for the environment. These powers will also affect the world of education, especially schooling (Anderson, 2013, Mulford, 2008).

20 It is agreed that humans are the main cause of climate change. The environmental problems in the world civilization in the 21st century have obligated the world of education to change the old paradigm which gave too much emphases on the science for the sake of the science, and the art for the sake of art into a new one which gives a priority to the sustainable values, attitudes, and behavior (BNSP, 2010). The paradigm is known as the literacy aspect (Deswari, 2018; Hines et al., 2014; Palmer & Neil, 1994; McBride et al., 2013; NSF, 2019;).

The sustainable environmental education encounters an obstacle in integrating learning materials. Integration is needed to grow values and attitudes that end with behavioral changes. The ownership of strong values among students will result in sustainable behavior. The behavioral changes model proposed by Fishbein (1975) and Kollmus, A (2002) shows that sustainable behavior will not be formed if students do not have any values built by the knowledge presented in proper methods.

Exploration and internalization of values in students are key words for reaching success in forming attitudes and behavior (Schultz, 1972). On the contrary, any failure in integrating the values is a serious threat to the development of the students' way of thinking, values, attitudes and behavior and this may threaten the their life safety and environment in the future. Learning activities using the CBL model give an emphasis on the importance of exploration and internalization of conserving values that will build their attitudes and behavior (Sukarsono, 2018).

## REVIEW OF LITERATURE

### Water Cycle Literacy

An issue of literacy in the field of environment firstly attracted to attention of the world in the UN conference held in Stockholm in 1972 (Palmer, J. A. & Neil, Philip, (1994); Blessing, 2012). Environmental literacy refers to certain literacy that shows behavior responsible for the environment. Literacy starts from some awareness of and care for problems dealing with the environment and then proper actions are taken to solve the problems (Deswari Nurul, 2019).

Referring to the general understanding of environmental literacy, water cycle literacy, if it is related to some ideas proposed by experts, is not merely the knowledge aspect but should also be supported by other aspects to realize proper behavior towards a sustainable water cycle. It is the attitudes of and care for the water cycle that may then grow one's motivation to realize behavior of caring for the water cycle (Blessing, 2012). Another expert states that water cycle literacy includes any knowledge of water cycle issues, knowledge of actions, and action behavior showing good attitudes towards water (Hines, et al., 2004).

A water cycle is defined by experts as an event of a simple cycle consisting of evaporation, condensation, precipitation, and runoff. However, this cycle is greatly complicated and is not fully understood (NOAA, 2019). Although principally the total amount of water in the cycle is constant, its distribution in various process always changes (Encyclopaedia Britannica, 2019). A water cycle is an endless process connecting all water in the earth. A water cycle contains more events, instead of merely raining and evaporation. One of the events is the cloud which is another way to return water into the land (National Geographics, 2019).

Changes in a water cycle are be caused by high tension and changes in the water cycle itself. Direct tension in the hydrological system comprises of changes in the land allotment, urbanization, industrialization, and significant changes in techniques. Indirect tension comes from human population growth to meet their needs for freshwater, cleanliness, foods, and energy (Bridgewater, et al., 2018).

Based on the experts' viewpoints, it can be stated that a water cycle is not a simple cycle event, but it involves various types of complicated events that are in itself directly related to humans. Even, this involvement has resulted in a great disturbance that spoils the water cycle globally (NASA. 2019). Any disturbance to the changes affects the sea level, the sea salinity, and the biophysical characteristics of soil surface. All of these changes, at last, give feedback to the climate globally. The runoff change due to the loss of vegetation and water infiltration to the soil causes some decreases in river runoff, and also in a yearly freshwater volume used by humans.

Human interest in water has made a water cycle as a vital event in the ecological system. But, each explanation of the water cycle either at school or in the university is hardly found even it never involves humans as a part of the components of a water cycle chain. No human involvement as one of the cycle components in the water cycle causes them to feel out of the cycle. Their actions to water are solitary following their desires since they are considered to be another component in the ecosystem and the cycle is not related to humans.

This limited water cycle literacy will stimulate students to think that they are separated from the natural system, including the water cycle in nature. Whereas in fact, water also always moves in the human water cycle – providing us with power to our houses, keeping water in our bodies, watering plants, supplying energy which is related to and depends on one another (NSF, 2019).

## **Water Cycle Values in Learning**

Like an ecosystem and its diversity, a water cycle is a phenomenon involving a lot of ecosystem components. It is recognized by experts in ethics that a water cycle possesses essential intrinsic values for conservation (Rolston 1986; Callicott 1989; Sandler, R. 2012).

Intrinsic values are those attached to and possessed by an ecosystem component and events in it. Human beings make evaluation intrinsically in accordance with knowledge they possess. It is expected that the higher the intrinsic values, the higher their attention to protecting the ecosystem will be. Besides intrinsic values, ecosystem components and their processes also own instrumental values. Instrumental values are ones possessed by the ecosystem components and their processes used to reach the goals of human beings (Kerry. 2013; Sandler, R. 2012).. These values are in the form of lists of goods and services given by the ecosystem, such as foods, beverages, fuels, building materials, fibres, medicines, land-sliding keepers, and the like (Daily G, 1997).

Contextual learning basically is a pragmatic effort given to students to understand natural events, including the water cycle. Learning models are developed to know pragmatic problems. From the pragmatic viewpoint, a water cycle and the whole process in it can be valued as the goodness of nature itself for the interest of human beings (Hampicke Ulrich, 1994). Fulfilling human needs from ecosystem services is more likely to approach them to be willing to improve ecology. Nature cannot wait until all humans possess the same understandings and values of nature, then it acts. Any damage to nature is caused by human beings who need it but who do not respect it as it should be (Norton. B, 1987, 1991).

## **Learning to Build Pro-Water Cycle Behavior**

Education is basically a conscious effort made to change behavior. Through education, the formed behavior will be based on individual consciousness. In general, behavior is still often equalized with action. However, Weber, M (1949) explains that not all behavior is an action. An action is meaningful behavior (Weber. M, 1949). Social action is meaningful behavior directed to other people. Therefore, an environmental action is meaningful behavior targeted to the environment. An action is duration that lasts in behavior (Schultz. A, 1972). An action is a series of experiences formed through actors' individual consciousness (Weber.M, 1949; Schultz. A, 1972). Although there is little difference in giving meaning between the two figures, but there is one thing to agree that an action is meaningfully conscious behavior. Any pro-environmental action cannot merely be based on consciousness, but the consciousness should be accompanied by meaning for its actors.

There are many educational activities intended to change students' behavior so that they possess some sustainable conservation actions. Educational products should be seen in the activities in developing the world society with the pro-environment. But as a whole, a sustainable development initiated by the UN is said to fail (ICEE, 2007). From the beginning, the failure had been predicted by experts (Hungerford, H. R., and T. L. Volk, 1990; Kollmuss. A, and J. Agyeman. 2002). It is caused by educators' inadequate ability in managing the environment-based learning (Sukarsono, 2018), and also by the implementation of the educational programs



that do not refer to the orientation of behavior and actions to sustainable environmentt (Frisk.E and Larson.K, 2011).

Activities in learning environment in schools in Indonesia are carried out in two approaches: 1) the environmental materials are integrated with school curriculum, and 2) monolithic curriculum serve as environmental curriculum . The two models have been being adopted up to now. However, the biggest complaint given by school teachers that should treat the environment as a mainstream in their learning activities is their difficulty in integrating the environmental materials into subjects or learning themes (Afandi Rifki, 2013; Kadorodasih, 2017; Eka Puspitasari, et al., 2016; Sudjoko, 2014; Sukarsono, 2018; Shanta Rezkita, 2018).

This difficulty is worsened by their inability in implanting environmental values into learning materials. It is also the case of the topic on a water cycle. The fact in the field shows that teachers merely present the learning materials in a one-way fashion. Students are passive. All learning activities are conducted of which teachers become the center in the learning process. Knowledge, consciousness and values obtained by students will be limited since all depend on the knowledge and the scenario mastered by the teachers. It is difficult for students to have some awareness and values needed to build pro-environmental behavior and actions from such a teaching-learning process . Some experts say that knowledge which does not have values will not be able to build any awareness, and any behavior which does not own values will not bear any actions. Knowledge improvement does not mean changes in behavior(Schultz.A, 2002).

### Conservation-Based Learning Model

The term *conservation* in various dictionaries shows almost the same matter, namely, it is a noun which means *preservation* or *protection*. A Large Dictionary of the Indonesian Language explains the term *conservation* as a form of maintaining and protecting something regularly to avoid any damage or extinction by preserving; preservation (KBBI, 2019).

Conservation gets special attention from Indonesian government and society. This This can be seen from a special law on Conservation (Law Number 5 year 1990) and The Government Regulation Number 18 year 1994, Number 68 year 1998, Number 7 year 1999, and Number 8 year 1999. The laws and the Government regulations of the Republic of Indonesia on Conservation have three main principles: protection, preservation and sustainable utilization.

A conservation-based Learning model is better known by teachers and supervisors at schools as a CBL model. This model is proposed by Sukarsono (2018) as a response to various problems in environmental learning at schools in Indonesia. One of the greatest problems in implementing the environmental learning is teachers' low ability in integrating either concepts or principles of environment into learning materials (Afandi Rifki, 2013; Shanta Rezkita and Kristi Wardani, 2018; Kadorodasih, 2017; Eka Puspitasari, et al, 2016; Sudjoko, 2014). Their low ability may impact students' low ability in mastering environmental concepts. Referring to ideas proposed by Weber (1949) and Schultz (1972), the implementation of education will fail in building valuable awareness, and actions, or behavior. No action made from learning results also means that the learning process is also unsuccessful.

The CBL model determines four main steps (syntax) to solve the failure: 1) Identifying and strengthening concepts of learning materials; 2) Integrating values of conservation; finding values and characters of conservation; 3) Identifying problems and ideas of problem solving; 4) Arranging plans of activities or actions; Planning solutions/Scientific Products (scientific papers, works of art-technology, activities or actions of conservation); and 5) Giving follow-up and evaluation (Sukarsono, 2018).

## METHODS

This research was carried out using a quasi-experimental method. Student population was from three area namely Malang city, Malang regency, and Batu city, East Java province. The sample was randomly taken namely two schools from each city. For each school, two classes, for the control and experimental groups, were determined. The number of students involved in this research was 396 students, consisting of 196 students as the control class, and 200 students as the experimental class.

A control class is a class applying a learning model which is usually adopted by teachers (called the common classes). While, an experimental class is a class taught using a CBL model (called CBL classes). The differences in the learning steps between the common and the CBL model are presented in Table 1.

**Table 1.** Comparison between common and CBL model in learning water cycle literacy

No	Common Model	CBL Model
1	Delivering information on a water cycle	identification and reinforcement of concepts on a water cycle
2	Discussing and answering questions in the learning guide book	An Integration of Values of Conservation into learning Materials
3	Discussing problems provided by teachers and their solutions.	Formulating problems and their solutions by students
4	Evaluation	Formulating plans of activities in line with the students' problems and interests
5		Implementing activities and evaluation

Source: Sukarsono (2019)

The materials on a water cycle in the 2013 curriculum are presented in class X semester 2. The basic competence determined by the governments is to analyze a hydrosphere and its impacts on life on the earth. In general, teachers in the three cities implemented learning activities using lecturing and discussion methods. When problems that should be solved by students exists, the students usually came from teachers. Two out of six classes applied a project method, namely making hydrosphere mockups. Whereas, in the experimental class, steps of learning with the CBL model were used. The stages emphasized an integration of conversational values into learning materials, so that students could find problems about water cycle by themselves, families and or societies. On the basis of the problems, students formulated solutions. The solutions made could be in the form of actions, scientific papers or products dealing with a water cycle.

For the benefits of this research, a water cycle literacy guide using the criteria summarized by the researchers on the basis of the ideas from some experts and policies in some countries was used. The ideas and the policies are presented by Hines, et al (2014); *National Curriculum Council* proposed by Palmer, J. A. & Neil, Philip, (1994), *North American Association for Environmental Education* presented by McBride, et al (2013), NSF (2019) and proposal given by Deswari N (2019). The result of the summary is presented in Table 2.

**Table 2.** Aspects of Water Cycle Literacy

No	Aspects of Literacy	Indicator
1	Knowledge of Water cycle	<ul style="list-style-type: none"> <li>a. Understanding of water cycle (components, process, etc)</li> <li>b. Anything dealing with water cycle (social, economic, etc.)</li> <li>c. Factors influencing water cycle</li> <li>d. Issues on local and global water cycle</li> <li>e. Water cycle – Human beings</li> <li>f. Knowledge of action strategy</li> </ul>
2	Values of Water cycle	<ul style="list-style-type: none"> <li>a. Respect to water</li> <li>b. Respect to the existence and process of water cycle</li> <li>c. Respect to components of ecosystem in water cycle</li> <li>d. Respect to water cycle for oneself and life</li> <li>e. Respect to policy on water cycle</li> <li>f. Respect to knowledge, attitude and behavior</li> </ul>
3	Attitudes towards Water cycle	<ul style="list-style-type: none"> <li>a. Having sensitiveness and appreciation to water cycle</li> <li>b. Being focused on problems of water cycle</li> <li>c. Caring for water cycle</li> <li>d. Being responsible for the preservation of water cycle</li> <li>e. Being responsive to problems in water cycle.</li> <li>f. Having awareness of preservation</li> <li>g. Respecting others' opinions about water cycle</li> <li>h. Having a desire to bring some changes in the problems of water cycle</li> </ul>
4	Cognitive Skills in Water cycle	<ul style="list-style-type: none"> <li>a. Identifying, defining, and/or analyzing problems of water cycle, synthesizing and evaluating issues in water cycle from various sources</li> <li>b. Looking for information related to water cycle</li> <li>c. Communicating problems of water cycle</li> <li>d. Planning collaborations</li> <li>e. Being skillful in choosing strategies of applying the concept of ecology</li> <li>f. Solving problems of water cycle</li> <li>g. Being skillful in finding issues and solutions concerned</li> <li>h. Participating in making policies of water cycle</li> </ul>
5	Skills acted on conserving Water cycle	<ul style="list-style-type: none"> <li>a. Participating in activities dealing with Participating in water cycle</li> <li>b. Making relevant actions</li> </ul>

		c. Making collaborations d. Making investigations and scientific analyses related to water cycle e. Doing proper actions and making evaluations
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Source: Sukarsono (2019)

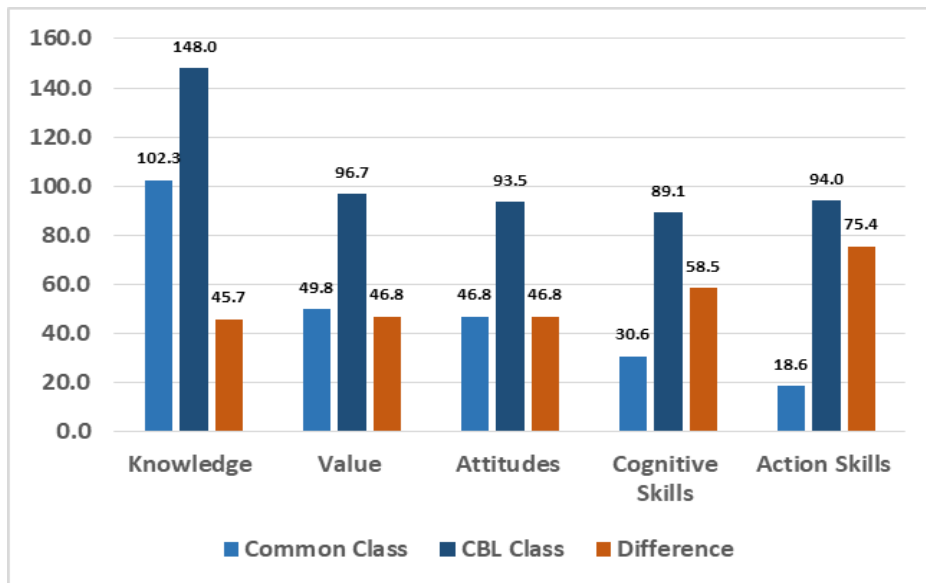
Quantitative data collected were data on the frequency of literacy numbers possessed by students from 33 literacy aspects as presented in Table 2. While. Qualitative data were obtained from interviews and discussions during the teaching-learning processes.

**DATA ANALYSIS**

Data collection was done by using a non-test method through observations and interviews. Results of observations showed the frequency and aspects of literacy owned by students. The average frequency of literacy aspects from the control and experimental groups was sought to analyze the normality and homogeneity using the Kolmogorov-Smirnov Test. Then, to understand whether there would be a difference in the average frequency between the control and the experimental groups, an Independent Samples Test was carried out. Qualitative data from each literacy aspect was used to support descriptions of quantitative data. Data from the results of analyses are presented in the forms of tables, bar chars accompanied by description.

**RESEARCH RESULTS**

Data on frequency of ownership of literacy aspects of water cycle in the common and CBL classes and the difference between the two are shown in Picture 1.



Picture 1. Average frequency of each water cycle literacy aspect of students in common and CBL classes

In general, average frequency in each literacy aspect in the CBL class was higher than that of the common class. Knowledge aspects occupied the highest order of literacy, either in the common class or the CBL class. The frequency of aspects of values, attitudes and cognitive

behavior and its skill behavior was almost the same in the CBL class, while in the common class, the frequency tended to decrease. The difference in the frequency of water cycle literacy was increasing in the CBL class from terms of the knowledge aspects to behavior skills (consecutively 45.7, 46.8, 46.8, 58.5, and 75.4)

The results of the normality and homogeneity tests using the *One-Sample Kolmogorov-Smirnov Test* showed that all data were normal and homogenous. From the results of the data analysis using an Independent Samples Test, a significance value of 0.000 was obtained. This showed that a learning treatment using the CBL model significantly affected students' ownership of literacy aspects of a water cycle ( $\text{sig } 0.000 < 0.05$ ). A summary of the data of statistics analysis is presented in Table 3.

Table 3. A summary of data statistics analysis

Table 3.a Group Statistics

Class	N	Mean	Std. Deviation	Std. Error Mean
Common Class	33	49.242	41.0602	7.1477
CBL Class	33	103.000	39.6508	6.9023

Table 3.b Independent Samples Test (t-test for Equality of Means)

	t	df	Sig (2-tailed)	Mean Difference	Std. error Difference	95% Confidence interval of the Difference	
						Lower	Upper
Equal variance assumed	-5.410	64	.000	-53.7576	9.9364	-73.6077	-33.9074
Equal variance not assumed	-5.410	63.922	.000	-53.7576	9.9364	-73.6082	-33.9070

### Literacy of the Knowledge Aspect of Water Cycle

The research results showed that the percentage of the ownership of water cycle literacy in the students from the CBL class was higher than that of the common class. Water cycle literacy in the two groups was highest in the knowledge aspect. This aspect is highest since the learning activities in the two classes contain the stage of strengthening concepts. The activities in strengthening the concepts were conducted in various ways from lecturing, reading, watching videos, questions and answers, and the like.

The common class model emphasized learning cognitive aspects; the mastery of concepts on a water cycle. To understand the water cycle better, the students in the two common classes were obliged to make mock-ups on the land hydrology system or water purification. Students' literacy from the common class group concerning the knowledge aspects was focused on the literacy on concepts of a water cycle, ecosystem components and its impacts as stated in the guide book. While in the CBL class, the students obtained new concepts out of the guide book, for instance, something about a humans-water cycle. Concepts of humans-water cycle were given serious attention from students since it is directly related to themselves, families, and society around them.

Water cycle literacy in the knowledge aspect is owned by two research classes around definitions, orders or components of a water cycle, the causes and disturbances of the water cycle. Some examples of statements in the two classes are among others as follows: 1) indicators of orders a water cycle are : evaporation, transpiration, evapotranspiration, sublimation, condensation, advection, precipitation, run-off, and infiltration”; 2) indicators of water cycle components: “If the forest is destructed, the woods are cut down, floods and land-sliding will occur”; 3) indicators of water cycle disturbances; “Air pollution will increase the air temperature, and this increases the evaporation and it can result in flood”

Statements of water cycle literacy in the CBL class which were not found in the common class were on a human-water cycle. The examples of such a student’s statements areas follows: 1) indicators of human-water cycle: “We use water, we utilize water, and throw away its pollutant to the river than it flows into the sea and then it enters into a water cycle” or “Water rests in one’s body. From the body, it is released to the river.”

### Literacy of the Value Aspect of Water Cycle

Ownership of value aspect literacy of a water cycle in the common class was lower than that of the CBL class. The difference is almost three-fold. A great difference in the literacy of this value aspect possibly occurs because the common class did not explicitly make either the step of exploration or integration of the values into learning materials. No specific stage of integrating the conservation values into the learning materials caused low ownership of value aspect literacy in the students. Statements of the water cycle literacy value ranged from respect to water for humans and the cycle processes that should be kept. Some statements are among others as follows:

“When the trees in mount Arjuno are cut down, flood will happen, all wetland, gardens, live-stocks, bridges will be washed away by the floods” (1.b)

“The tree has better benefits to absorb water to the land. So, if you want to plant a tree, it is better if the tree may absorb water into the land” (1.i)

“If artificial rain may ruin and disturb water cycle, why does the government do it...?” (1.j)

The success of integrating conservation values into the subject matter will make students more interested in the subject matter. Likewise, the attitude that is built up in students will be better.

### Literacy of Attitude Aspect of Water Cycle

The attitude aspect of water cycle literacy in CBL classes is higher than that of common classes. This situation is very natural to happen, considering a person's attitude will depend on the values that are owned by that person. The better a person's assessment of something, the better their attitude towards that thing. An attitude statement was usually made by students after they felt some values of a water cycle for them. The CBL class did the step of integrating conservation values, while the general class did not.

Data on attitude literacy explored using open worksheets enabled students to show their attitude spontaneously. This spontaneous attitude was considered to be stronger and to reflect their real

attitude compared with the list of attitudes provided by the researchers and that should be chosen by the students. The statements of attitude literacy are among others:

“Our school should have bio-pores so that rain waters return to the land and no puddles are found” (2.d)

“Water from the bathroom or from tap water may be reused for example, to water plants, fill in the fish pond, don’t throw it away to the ditch.” (2.b)

### **Literacy of Cognitive Skill Aspect of Water Cycle**

Cognitive skills of water cycle literacy in the common class was lower than CBL class. The number of the common class practicing the water cycle was just two out of twelve classes examined. While four other classes did not practice the activities and just stopped in the discussion activities.

Cognitive skills of water cycle literacy in the common class emerged in two schools due to practicing activities designed by the teachers. The activities were to make hydrology mockups and sample tools of water purification. The design of the water purification tool and the hydrology mockups had been made by the teachers, but students should also make imitations. The skill of imitating includes a cognitive skill although it is at the low level. During the discussion, the common class also showed some cognitive thinking skills to solve problems. But, the problems discussed had been provided by the teachers. Students should also respond to the problems and give a solution leading to the activities of water purification or making the hydrology mockups. One unsatisfactory thing happened when the teacher was asked by the researchers he made such a tool, but he answered that “what is important here is that there is an activity, it is better than not.”

The CBL class guided students to be able to find problems interesting and important for themselves, their families and their environment. That is why, when they had found something attracting and significant for themselves and their environment, their cognitive skill would be forced to think of something giving solutions.

Besides its number, cognitive skills literacy in the CBL class was also varied than the common class. In each group, even most individuals had opinions, suggestions or proposals of activities dealing with the water cycle. Some of the statements are for examples as follows:

“what we are able to make at school is to make programs for school, class, or house, for example, we may make bio-pores, or others (3.c)

“We should save water, in the ablution water in the mosques, for instance, should be given a reading “Save water”. This may also be placed in the toilets and the bathrooms.” (3.d)

“Good. Water from the ablution water or the bathroom can be used to water plants, fill in ponds, so don’t be thrown away.” (3.g)

“Plant trees so that this school is not always hot and when it is raining, it will not cause a flood.” (3.e)

“Good, the water should be clean, ok? It will later be good for human health, it will not cause diseases. We should keep the water clean.” (3.a)

### **Literacy of Conservation Action Skill of Water Cycle**

What is striking resided in the aspect of the action behavior in the common school which was very small than the CBL class. The learning model that had been applied in the class up to the time literacy of knowledge literacy instead of values, attitude,s and behavior. The behavior shown tended to be the cognitive behavior designed by the teachers, but it gave little impact on the real behavior needed by the environment itself. For example, in the two common classes, the teachers prepared activities of purifying water and making hydrology mockups. These two activities were simulative in nature and should be asked about their direct roles in students’ real life. Skills produced by students were not any action that is based on students’ awareness, but the one encouraged by the teachers’ expectation which are not certainly agreed and needed by students. In the CBL class, students’ cognitive skills were highly because they themselves who have their real interest and problems in their real life. On the basis of their interest and problems, students looked for solutions that would give direct impacts on their life.

Water cycle literacy in the form of the behavior of action in the CBL group could be identified in all classes. The form of the product of learning water cycle literacy was decided by the students themselves to become group and class activities. The forms of the learning products were classified into three namely writing scientific papers, making products or implementing activities. Several actions literacy decided by the students are harvesting rainwater by making bio-pores, holding ablution water to fulfill the need for water to water plants, campaigning water saving at school, making papers, reports of visitation to the factory producing packaged freshwater and planting fruit tree seeds at school.

The plan of the students’ actions in the common class greatly led to actions guided by the teachers. These activities emerged from a question asked by the teacher to the students about what should they do when water pollution happens. The question is from the results of the explanation about the disturbance to the water cycle due to pollution.

### **DISCUSSION**

Water cycle literacy between students in the common class and the CBL class quantitatively was different. The CBL class, on average, showed a high frequency of indicators than the common class. The CBL model respected and emphasized that the topic learned had important or very vital values for students. Teachers or lecturers have to facilitate their students to find by themselves the values contained in each learning material.

The topic of the water cycle must be discovered and understood by students as events that involve themselves, and not just as natural events that are outside of themselves. The tendency of humans to pay more attention to themselves compared to nature, will influence the risk and environmental management, including in the water cycle.(IUCN, 2008).

The CBL model stimulates students to find their own interests and problems. For students, to really understand and may accept the science, they should work to solve problems, discover something for themselves, and always work on ideas. The task of education does not only pour a



number of information to students' brain but also try to implant important and vital concepts in them strongly (Kamil Mustofa, 2017).

Learning activities using CBL model considers students to have owned literacy from their daily experiences, either from their school or environment. A bit of information will have a place in the learning activities and each student has a right to associate the obtained information to the new literacy (Bruce Joyce et al., 2011). The fact causes the students in the groups using the CBL group to possess a more complex water cycle literacy than those in the common class group.

A striking difference between the common class and the CBL class may be found in the value, attitude, and skill aspects. This has been explained by some experts that in general, some improvements in knowledge do not mean to result in changes in behavior if it is not accompanied by values (Schultz, 2002). Moreover, two-way intensive learning activities greatly affect students' desire to think and to be active in learning.

## CONCLUSION

Water cycle literacy among secondary high school students may be significantly developed through the application of the CBL model. Improving literacy covers the mastery of concepts and the emergence of conservation values in the students. Any values emerging from the students about a water cycle include intrinsic and extrinsic values. The values are predicted to bear students' behavior and action, which are the pro-water cycle. It is expected that the application of the CBL model in the material of the water cycle will result in any action which is pro-environment sustainably.

The CBL model that has been tried out in the limited scale in three cities in East Java province Indonesia is expected to be well responded and applied in other cities and provinces in Indonesia. More widely, this model application program will be able to be tried out in other countries that have strong concern with the future of human beings and this planet as a habitat for living together.

An ability to build values since the beginning of the learning activities will be able to promote the students to possess the attitude and cognitive skills needed through materials taught. Any sustainable action may be expected to be born from the values and attitude build in the students, therefore so that improvement in the water cycle literacy will not only occur to the knowledge aspect but also to the value, attitude and sustainable behavior aspects.

## RECOMMENDATION

Based on the research conducted in three cities in East Java, it is suggested that the CBL learning model possess potency to help teachers and students attain their learning goals especially in water cycle literacy. Learning characteristics of the CBL model enabling to help teachers and students dig out values, attitudes and behavior, pro-environment will promote a more conducive learning process. This effort is expected to be one of the answers to the UN's suggestion that the world community looks for various new models in learning activities to support sustainable development.

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Students directly feel the river flow and measure the depth of the Brantas River in East Java



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