Integrated learning for improving environmental literacy in high schools

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Abstract. The environmental issues that happened in the northern part of Central Java are getting worse. Human activity is believed as the main factor of environmental damage. The effort to change the young generation’s perception, awareness, and action about the environment through education will become the best way to fix these challenges. This research is aimed to develop environmental literacy-integrated learning in high schools and to improve student’s environmental literacy. This research use mix method with a qualitative approach to examine the quality of environmental literacy-integrated learning. Then, the quantitative approach also used with quasi-experimental with pre-test post-test Non-equivalent Control Group Design to measure the effect of environmental literacy-integrated learning. This study involved 34 students both in the experimental and control class. The instrument used in this study is Middle school environmental literacy surveys (MSELS) questionnaires and observation sheets. The qualitative data is also used to evaluate the implementation of environmental literacy-integrated learning. The result shows that environmental literacy-integrated learning gives a positive impact on student’s comprehension in all environmental literacy aspects. In addition, the statistical analysis also shows significant value as 0.000 (p<0.05). This result indicates that environmental literacy-integrated learning can improve student’s environmental literacy.

1. Introduction
Environmental problems nowadays become a global issue. Indeed, environmental issues such as waste materials, aberration, global warming become the main concern to the government in every nation. Thus, the preventive ways are now being developed with the effort to change human’s behaviour. Indeed they can increase their awareness of the environment. They did it through education. Environmental literacy are integrated in educational system and become primary topic for students to learn in the schools. In U.S. environmental literacy were tried to implement and assess [1], moreover environmental literacy assessment were developed too with focus on four aspects including ecological knowledge, environmental cognitive, attitude toward environment, and actual commitment [2]. Environmental literacy not only focused on environmental knowledge, but also for self-actualization and behaviour, strategy and media for developing knowledge, acquisition of value toward environment, and ability to make planning for developing their environmental literacy. Thus, integrating environmental literacy in educational practice will give a good insight for the better environment condition and human life in the future. The young generation will be called upon to understand simple to complex environmental problems, analyse and assess opportunity and risk,
making plans, evaluate them, and make decisions that affect the environment in local or global scale [1].

Improving environmental literacy in the educational practice was facing a lot of challenges. In Taiwan, most of teachers and students have satisfactory level in environmental knowledge and attitude, but presented low level in environmental behaviour/action [3][4]. While in U.S. most of student’s environmental literacy are in the mid-levels [2]. Moreover, based on research done in the schools of coastal area in Central Java, Indonesia, the level of student’s environmental literacy is in low levels [5]. Furthermore, the identification issues indicator has the lowest level and the highest one is general environmental feeling. The low degree of environmental literacy is reflected by the condition of those schools. Many schools in coastal area of Central Java are not well supporting environmental literacy. They also had not proper facilities because they often got flooded because of aberration and a bad waste management. The schools itself try to implement environmental literacy especially in science subject. However, the result was not promising. Some teachers were not fully understood in environmental literacy and how to express it in their class. They have difficulty to choose and develop learning strategy to foster literacy.

The efforts to implement environmental literacy in education were done by some researchers. Some of them integrate some course emphasize issue investigating-evaluation and evaluation training with focus on literacy and behavior toward environment [6]. The other way to integrate environmental literacy was making summer environmental education program, that fully train students in knowledge, affect, skills, and behavior in one specific time. However, the result was not promising because there were no differences between pre and post result in student’s environmental literacy [7]. The efforts to implement environmental literacy then develop in specific scale in teaching and learning practice. The first thing that had been done was designing curriculum with embedded environmental literacy in learning practice [8]. It put environmental literacy indicators in curriculum and implemented it with certain learning method. One of the learning methods that establish already in promoting environmental literacy is collaborative learning [9]. Collaborative learning which refer to the interaction between pair and/or among pairs of students working on project give contribution in expressing environmental literacy in classroom. It supports the student’s environmental literacy development. The effort to integrate environmental literacy in learning practice was not only done in learning method, but it broadens in learning media, reference, and all of learning materials. The textbook based on environmental literacy also being developed and it proved to be able to increase student’s environmental literacy [10]. Thus, it required a holistic integration that involved all of learning components to make fully improvement in environmental literacy.

2. Method
This study examines the integrated learning for environmental literacy in fostering students’ environmental literacy acquisition. Integrated learning in this study includes problem based learning models, environmental literacy KIT and text book. This research use mix method that involved qualitative method in describing how integrated learning is implemented in the classroom. Then, quantitative approached is used with quasi experiment Pre-test post-test Non-equivalent Control Group Design. The research used cluster random sampling. It involved 68 senior high school students both in control and experimental class. The students in experimental class were taught by integrated learning while control class was conventional mode.

The instrument administered to students was the Middle School Environmental Literacy Instrument (MSELI) [2]. The instrument includes several demographic items and measures of the following environmental literacy components: ecological knowledge; verbal commitment; actual commitment or environmental behaviour; environmental sensitivity; general environmental feelings; issue identification and issue analysis skills; and action planning. The instrument was given in pre-test and post-test. Thus, the data of Environmental Literacy collected by pre-test and post-test then scored and analysed using covariate analysis (ANCOVA). Before that, the data was analysed by normality test.
3. Result and Discussion

The environmental literacy-integrated learning were done in Biology subject and embedded in ecology and environment chapter. The curriculum then implemented in class using problem based learning strategy (figure 1.a). The problem based learning strategy was started with orientation and exposing environmental issues that happened in coastal area. The students then tried to solve the problem given. Thus, they would do some investigation in their groups. At this point they worked with the help of text book based environmental literacy (figure 1.b). The text book was organized systematically in four sections. In the first section, students were provided by a lot of issues in environment, this part represented environmental literacy indicators for issues identification and issues analysis. This part also gave students clear understanding of issues that given by the teacher before. The second part of environmental literacy text book represented ecological knowledge. In this part there were many information given related to environmental topic and theory. This section will help students to build understanding about environment and giving advance knowledge as the basic for their further action. The third part is specialized for attitude, feelings and verbal commitment toward environment. In this part, students also stimulated to share and socialize pro-environmental activity. Then, the last part of the text book was the action part. Here, students were helped to express their action to save environment. It included planning activity and building strategy for pro-environmental action and how to realize it.

In addition, the students did investigation activity with the help of learning media, KIT-based environmental literacy (figure1.c). In this KIT, the students were provided with some set of experiment tools about environment, especially in pollution and waste management. During investigation activity, students were allowed to use those KIT to get some data or supporting information to solve environmental issues that given before. Then, students did some discussion and making plan for expressing their actual commitment and behavior in saving environment. All of learning process was ended with evaluation and reflection about environmental issues.

![Figure 1. The implementation of learning integrated-environmental literacy. (a) problem based learning practice, (b) students in using environmental literacy text book, and (c) the use of KIT-based environmental literacy.](image)

Further result showed that learning integrated-environmental literacy effect student’s skills in environmental literacy acquisition. The quantitative data also measured in comparing environmental literacy outcomes in learning integrated class with non-learning integrated class. It used anacova analysis and before that it already checked the normality data with the kormogolov-smirnov sign value more than 0.05 (p < 0.05) both in control and experimental class. The anacova result is shown in table 1 below.
Table 1. The anacova result of environmental literacy in control and experimental class

| Source            | Type III Sum of Squares | df | Mean Square | F    | Sig. |
|-------------------|-------------------------|----|-------------|------|------|
| Corrected Model   | 8331.280^a              | 2  | 4165.640    | 118.708 | .000 |
| Intercept         | 17927.823               | 1  | 17927.823   | 510.886 | .000 |
| pretest           | 2966.982                | 1  | 2966.982    | 84.550 | .000 |
| Class             | 5744.930                | 1  | 5744.930    | 163.712 | .000 |
| Error             | 4737.370                | 135| 35.092      |       |      |
| Total             | 889655.154              | 138|             |       |      |
| Corrected Total   | 13068.650               | 137|             |       |      |

a. R Squared = .638 (Adjusted R Squared = .632)

The result showed that sig. value is 0.000 that means there are differences between control and experiment class in environmental literacy outcomes. In addition, in each indicators of environmental literacy, both classes gave different result (Table 2). The highest score of environmental literacy in experimental class is ecological knowledge aspect, followed by general environmental feeling as the second high (Figure 2). However, the control class also has general environmental feeling aspects as the highest with similar score with experimental class. The lowest score of environmental literacy in experimental class is in issues analysis while the control class is in issues identification. Overall result showed that student’s environmental literacy was good both in control and experimental class, however the experimental class shown better result than the control class.

Table 2. The score of environmental literacy indicators

| Environmental indicators | Control class | Experimental class |
|--------------------------|---------------|-------------------|
|                          | mean | sd    | mean | sd    |
| Ecological knowledge     | 72.40 | 12.42 | 87.39 | 9.72  |
| Issues identification    | 64.58 | 25.04 | 85.83 | 18.41 |
| Issues analysis          | 75.49 | 18.99 | 83.81 | 14.46 |
| Verbal commitment        | 73.63 | 9.50  | 85.40 | 8.57  |
| Environmental sensitivity| 67.51 | 10.25 | 85.09 | 8.34  |
| General environmental feeling | 86.91 | 14.48 | 87.14 | 15.43 |
| Actual commitment        | 73.09 | 9.31  | 86.24 | 7.32  |

Figure 2. Difference of Students’ environmental literacy acquisition in experiment and control class

(*note: EK= ecological knowledge; II=issues identification; IA= issues analysis; VC= verbal commitment; ES= ecological sensitivity; EF= general environmental feeling; AC= actual commitment)
Based on the data analysis, it proved that learning integrated-environmental literacy gave positive effect on student’s environmental literacy level. The PBL model that becomes the core of integrated learning surely gave a lot of contribution in enhancing student’s environmental literacy [11]. In PBL, the students started learning with contextual environment problem. They need to analyze these problems first and making team work to solve those problems. The activity in analyzing environmental problem will directly promote identification issues and analysis issues aspects in environmental literacy. In many researches, PBL showed positive effect in developing students thinking skills, especially in analyzing skills [12, 13]. Furthermore, PBL also enable students to get more information and knowledge [14]. In solving problems, student will force to search information related to those problems. They will process the information and accumulate new knowledge.

In addition, the using of environmental literacy text book help students to get information easily. The environmental literacy text book helps students to think systematically. It contributed learning resources that were accurate and beneficial to the students. Thus, they can work in correct ways and finish their work faster. The using of text book also reported gives more positive effect in student’s learning experience and scaffolding to explore learning content [15]. It can promote student’s literacy and their learning outcomes [16, 17]. Moreover, the using of environmental literacy KIT also gave some contribution in promoting student’s environmental literacy. The KIT will help students to get more insight into environmental issues. They will be able to generate data and fact that support their work in solving environmental issues. Further, students can generate idea and make action that will influence their behaviour toward environment. The using of KIT also reported give some benefit in improving environmental literacy in many aspects, in the term of knowledge, cognitive skills, attitude, and also behaviour [18][19]. The ability of integrated learning to improve student’s cognitive and knowledge about environmental issues will affect the student’s attitude and behaviour. Based on the data above, the environmental literacy in attitude (environmental feeling, sensitivity, and verbal commitment) and behaviour actual commitment aspects were in good point. It means that the ability to think deeply about environment will influence student’s attitude and behaviour [20].

4. Conclusion

The integrated learning for environmental literacy was constructed by PBL model as the core of learning process and it enhanced by environmental literacy text book and KIT that contain indicators of environmental literacy (ecological knowledge, issues identification, issues analysis, verbal commitment, general environmental feeling and actual commitment). Furthermore, the integrated learning which is taught in the experimental class is better in fostering student’s environmental literacy level compared to the control class. Most students get the highest score in ecological knowledge and the second is general environmental feelings, while the lowest score is in issues identification and analysis. Thus, it suggests to implement integrated learning in developing environmental literacy and it will be better if the environmental literacy is implemented for any educational practice.

5. References

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