The Achievement of 21st-Century Students' Plant Literacy Through Field Trip Implementation

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Abstract. Research about the achievement of 21st-century students' plant literacy by field trip implementation has carried out to improve students' plant literacy. This study used a quasi-experimental method. This design includes a group of students observed in the pretest phase which is then followed by treatment with field trip implementation and ends with a posttest. The Field trip includes determining the aspects to be observed, carrying out observations, collecting data, discussion of results and reporting. Research instruments include a set of plant literacy questions and its rubric, worksheet for field trip students and its rubric, and a questionnaire about student response to the implementation of the field trip. There was a slight increase (N-gain 0.16) of students' plant literacy in the experimental class and the control class (N-gain 0.23). The result shows that the 21st-century students' plant literacy has the potential to develop through field trip implementation.

Keywords: 21st-Century Students, Student flied trip, Plant Literacy

1 Introduction

The emergence of plant blindness symptoms among students and lack of student interest in studying plants and the lack of learning time about plants at school [1], demanding an immediate plant literacy movement. Moreover, that is associated with the phenomenon of high deforestation in Indonesia which causes the extinction of various types of plants [2], therefore it's time to start promoting learning that can improve plant literacy. Plant literacy in this study refers to aspects of scientific literacy according to [3] which includes the context of science, scientific competence, and scientific knowledge. The scientific context in this study is in the form of a school park environment, science competence in the form of 21st-century skills critical thinking and problem-solving, and the scientific knowledge used is the concept of plant diversity.

One of the lessons that are expected to accommodate all aspects of plant literacy is a field trip. According to [4] the term "field trip" is usually used when someone or a group of people tour a different place than usual. When educational field trips are undertaken by students of an educational institution the main aim is not only recreation and pleasure but also gain additional knowledge through direct experiences. The chief purpose of the field trip is to give the pupils first-hand experiences that cannot be had in the classroom. Many of the objects of investigations can be studied best in their natural settings. Some research on field trips showed that field trips to natural locations were a beneficial learning aid and a means of fostering students' creativity and practices in education [5, 6], educational field trip is helpful to cope up with advanced

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learning, help to give a practical approach for the curriculum and it is helpful to develop more interest in learning among students [4]. So far, it has not been revealed the achievement of 21st - century student plant literacy by field trip implementation, especially in critical thinking and problem-solving abilities about plant diversity. Previous research on plant literacy shows that the application of Project-Based Learning can improve the ability of plant literacy in high school students better than traditional learning [7]. Besides through mini-research assignments, endangered plant literacy of Biology Education students reaches a good average [8].

2 Experimental Method

The research method used in this study is quasi-experiment with nonequivalent control group design, to reveal the ability of 21st century plant literacy in high school science students before and after carrying out field trips in the experimental class, while for the data control class, plant literacy skills were obtained from before and after carrying out conventional lab work. This research was conducted in high school in Cimahi, West Java. The participants in this study are 34 science students in the treatment class and 33 science students in the control class. The research was conducted in three stages, including the planning, implementation and final stages.

The planning stages include: (1) Literature review on field trip learning methods, 21st - century skills, scientific literacy, and plant literacy and theories about plant diversity. (2) Preparation of field trip learning plans and it's follow-up. (3) Preparation of learning devices and research instruments, including items about plant literacy and the rubric, worksheet on field trip learning and rubric, conventional lab worksheet and rubric, field trip and conventional observation sheet, and questionnaire. (4) Dissemination of field trip learning by teacher to students. The field trip includes the preparation stage (determining the aspects to be observed), implementation (carrying out observations and collecting data) and the final stage (discussion of results and reporting). (5) Conducted pre-field trip learning in the experimental class, namely students identified problems for the field trip and the purpose of observation.

The implementation stages include: (1) Pretest about plant literacy in experimental class students (field trip learning) and control class students (conventional practicum learning). (2) The field trip was carried out in the experimental class at the high school Park in Cimahi, West Java and conventional practicum learning in the control class, according to the demands in each worksheet. The observations about these learning were carried out during learning in both classes. (3) Posttest about plant literacy in the experimental class and in the control class. (4) Distribution of questionnaires about student responses to the implementation of field trips in the experimental class.

The final stages include: (1) Processing and analyzing data about student plant literacy, the implementation of learning, and the results of the worksheet in the experimental class and on the control class and student response. (2) Drawing conclusions and reporting.

Respondents in this study were 34 students of science class X at one of the Cimahi high schools in the odd semester in 2017/2018 school year as an experimental class and 33 other students of science class X as a control class. All answer sheets for plant literacy and worksheets were examined and given a score of 10 for each question. The 21st-century plant literacy competency refers to 21st-century skills according to [9] which is one of the critical thinking and problem solving which as part of learning and innovation skills. Normalized-gain

(N-gain) and the level of the category of increasing each plant literacy skill about plant diversity are calculated using the formula from [10].

3 Result and Discussion

From Table 1 it can be seen that through the application of field trip learning almost all aspects of student plant literacy increased, even though the increase was in a low category (N-gain=0,16). Likewise, with the control class, the increase was also low with the N-gain value = 0.23. Because there are significant differences between the pretest values in the experimental class with the control class with the value of t count = 5.35451> from t table = 2,000 at α 0.05, then the N-gain value becomes more important. The posttest value was not significantly different between the experimental class (33.6) and the control class (33.9) with t count = 0.112892 <from t table = 2.000 at α 0.05.

Both in the experimental class and the control class, the highest aspects of plant literacy were found in reason effectively. The indicator used for reason effectively is reasoning to solve problems. As many as 44% of students in the experimental class answered that the role of plants in overcoming drought is that plants can absorb and store water reserves and produce oxygen. Only 9% of students in the experimental class can answer the question of reason effectively by relating it to the function of the root as an organ that can absorb water in the soil, according to [11] opinion. In the control class, 55% of students answered that the presence of plants made the air fresh, produced oxygen and absorbed carbon dioxide.

Table 1. The average mastery of plant literacy in experimental class students (N = 34).

No.	Plant Literacy Aspects	Experimental class (%)			
		Pretest	**Worksheet**	**Posttest**	**N-Gain**
1	Reason effectively	44,1	-	65,7	0,39
2	Use systems thinking	15,9	55,7	34,6	0,22
3	Make judgments and decisions	33,7	57,5	30,9	0,00
4	Solve problems	10,8	-	18,6	0,09
	Average	**28,4***	**56,6**	**33,6***	**0,16**

*) Significant on α=0.01; - : No data

After applying field trip learning, student's ability of reason effectively increased with an N-gain value of 0.39 which was moderate (Table 1). Unlike the ability of students in the control class which applies conventional practicum, the increase in reason effectively ability was low, namely N-gain 0.03 (Table 2). This indicates that field trip learning is appropriate for improving reason effectively abilities.

Make judgments and decisions as one of the aspects of plant literacy, critical thinking and problem solving did not show an increase in students in the experimental class, even though it is assigned in the field trip learning worksheet. On the other hand, in the control class which only did conventional lab work, students' abilities in this aspect had an increase with N-gain of 0.23. The possibility of this occurs because these aspects are not trained in daily learning, including other aspects of critical thinking and problem solving, such as solving problems and thinking systems.

Table 2. The average mastery of plant literacy in control class students (N = 33).

No.	Plant Literacy Aspects	Control class (%)			
		Pretest	**Worksheet**	**Posttest**	**N-Gain**
1	Reason effectively	21,2	-	29,3	0,03
2	Use systems thinking	19,2	58,7	37,1	0,18
3	Make judgments and decisions	10,4	-	32,3	0,24
4	Solve problems	18,2	-	36,9	0,20
	Average	**14,3***	**58,7**	**33,9***	**0,23**

*) Significant on α=0.01; - : No data

Decreasing the ability of experimental class students on indicators makes judgments and decisions probably due to the mastery of the concept is low. This is by the opinion of experts that to develop critical thinking knowledge is needed as a background [12], [13], and [14]. On one of the pretest and posttest questions in this aspect, it was asked about the evidence that plants have chlorophyll and their role in plant life. 32% of students did not answer or incorrectly answer in the posttest. Similarly, in answering questions about evaluating groupings of plants into kingdom Fungi and Plantae, 70% of students only answered that green plants had chloroplasts and did not consider the grouping at all. According to [11] fungi include heterotrophs, which are different from Plantae.

Although the increase is still in the low category, it turns out that 21-st century students' plant literacy achievements have the potential to develop through the field trip implementation. This can be seen from filling out the worksheet even though not all aspects of critical thinking and problem solving are revealed in the worksheet. The issue raised in this worksheet is based on the real situation of the field trip results, which corresponds to the opinion of [12] and [15] that the task should be based on simulations that approximate the real-world problems and issues. Assessment of worksheets based on evidence from observations during and after field trips is important in developing 21st-century skills. [16] Stated that classroom assignments and student work have crucial roles to develop 21st-century skills. It's just that these skills also need to be trained in other learning. According to [17] critical thinking skills can be taught, trained and mastered by students. This is in accordance with the opinion of The College and Work Readiness Assessment (CWRA) that critical thinking, analytical reasoning, problem-solving, and writing are "collective outcomes" that cannot fully be taught in any one class or year; so all teachers and faculty have a responsibility to teach for such skills within each subject area and discipline [15]. Furthermore, experts suggest integrating these thinking skills into the curriculum [13]. Research showed that many students could not think critically because their teachers could not integrate critical thinking into their instructional practices every day [18].

Besides, the type of assessment used also greatly affects the ability of 21st-century plant literacy which in this case is the aspect of critical thinking and problem-solving. The quantity and quality of questions that represent each indicator of critical thinking and problem-solving in this study need to be improved. According to the results of several expert research summarized by [12], the open-ended assessment is more appropriate for measuring critical thinking and problem-solving skills. Another possibility is that the pretest-posttest of critical thinking and problem-solving in this study should refer to the evidence observed during the field trip, thus supporting the real situation issue as stated [12, 15, 16, 19].

In this study, there seems to be a gap between the issues raised in the pretest-posttest question of critical thinking and problem solving with worksheets executed during and after the field trip even though some contain the same aspects. Maybe students are not allowed to internalize the results of field trips and maybe students are given less opportunity to answer posttest freely. Thus the six components in critical thinking skills which include interpretation, analysis, evaluation, conclusions, explanations, and self-regulation [9, 17, 19, 20] passed so only. This is different from the results of the study about the problem based learning application in developing students' skills of critical thinking skills in junior and senior high school [21, 22, 23] as well as at the undergraduate student level [24, 25, 26, 27]. Inquiry-based physiology laboratories also can improve students' critical skills [28].

From students' responses to the field trip learning shows that almost all students understand the purpose of the field trip, the observed aspects, the application of student knowledge and its effectiveness in its implementation. Overall students respond positively to the learning atmosphere of biological science through field trips that are different from classroom and laboratory learning. This is supported by the results of [29] and [30] research that field trips can increase students' interest in science which can stimulate scientific literacy, specifically very helpful for students in studying biology [31].

4 Conclusion

The achievement of 21st-century student's plant literacy has the potential to develop through the field trip implementation. The best aspect of 21st-century plant literacy is reason effectively which is part of 21st-century skills of critical thinking and problem-solving. The ability of students doing field trip learning in other 21st century aspects of plant literacy such as use systems thinking, make judgment and decision problems and solving problems is no better than control class students. Therefore the implementation of field trips as a learning method needs to be improved, especially tasks in worksheets that contain 21st-century skills. Besides, assessment and management to capture 21st-century plant literacy need to be refined both in terms of quality and quantity.

Overall students respond positively to the learning atmosphere of biological science through field trips that are different from classroom and laboratory learning. This can stimulate 21st-century students' plant literacy.

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