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# Using Socio-scientific Issues in Problem Based Learning to Enhance Science Literacy

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**Abstract.** Context issue in science learning can be referred as one of the solutions to improve students' science literacy e.g. the socio-scientific issues. The socio-scientific context is presented in a problem where scientific knowledge and social awareness arise in mental conflicts that require science literacy to make responsible decisions. In addition, using problems in learning can provide opportunities for students to apply their knowledge in solving problems. Therefore, this paper discusses the usage of socio-scientific context in problem based learning to enhance students' science literacy. We show that problem-based learning with the socio-scientific issue can improve students' science literacy. Using socio-scientific issue makes it easier for students to make explanations of scientific phenomena.

**Keywords:** Socio-scientific issues; Problem based learning; Science literacy.

## 1. Introduction

Science literacy is skills that needed by students to deal in 21st century [1]. Scientific literacy is the ability of each individual to understand and apply knowledge in solving problems related to science and technology in everyday life [2]. It can be interpreted that science literacy is a skill that needed for personal decision making, participation in social affairs, culture, and economic productivity.

Recent times, Indonesian students' science literacy still below the international average [3]. This means that students are still considered to have limited scientific knowledge and can only be applied to some situations. The average of Indonesian students' science literacy has only reached the ability to recognize several fundamental facts, but they have not been able to communicate and link abilities with various science topics, moreover, apply scientific idea that interrelated [4].

The low level of science literacy is caused by some factors, especially is the lack of teacher's understanding of science literacy [5]. The preliminary research towards several science teachers in Cianjur District revealed that science teachers' understanding about science literacy was lacking. This research also revealed that science learning only focused scientific concepts. This fact provides evidence that students' science literacy is less trained in science learning at school.

Using appropriate contexts in science learning can be one of the solutions to improve students' science literacy, such as the socio-scientific issues [6,7,8]. The socio-scientific context is presented in a problem where scientific knowledge and social awareness arise in mental conflicts that require science literacy to make responsible decisions [9]. In addition, using problems in learning can provide opportunities for students to apply their knowledge in solving problems [10, 11]. Therefore, this article will discuss about using socio-scientific context in problem-based learning to enhance students' science literacy.



The rest of this paper is organized as follow: Section 2 describes the proposed research method. Section 3 presents the obtained results and following by discussion. Finally Section 4 concludes this work.

## 2. Research Method

This study used a quasi-experimental method that involved 64 eighth grade junior high school students. This research was conducted in one of the Cianjur District Junior High Schools. West Java. The research design used was non-equivalent Pre-test&Post-test Control Group Designs [12]. The experimental class was treated with problem-based learning with socio-scientific issues, while the control class used scientific approach. The research design can be seen in Table 1 below.

**Table 1.** Non-equivalen Pre-test&Post-test Control Group Designs

| Group      | Pre-test                                    | Treatment   | Post-test                                   |
|------------|---|---|---|
| Experiment | Pre-test to assess student science literacy | Problem based learning with socio-scientific issues | Pre-test to assess student science literacy |
| Control    | Pre-test to assess student science literacy | Scientific approach                                 | Pre-test to assess student science literacy |

The socio-scientific issue that used in problem-based learning is global warming. This topic was studied in 2 lesson (160 minutes). This topic consists of 3 subtopics: The causes of global warming, the impact of global warming and the solution to global warming. Global warming is chosen because it deals with various types of scientific disciplines and includes controversial issues. Therefore, global warming is the appropriate context as a socio-scientific issue.

Students' science literacy in this study is divided into 3 domains: science content, scientific processes and scientific attitudes. This study only assesses two domains science literacy, there are science content and scientific process. Instrument that used to measure these domains is multiple choice test. Moreover, this study also uses learning observation sheet. Data of science literacy processed using the t test. This test is used to determine differences students' science literacy in control and experiment group after treatment.

## 3. Results and Discussion

The results of this study discuss enhancing students' science literacy (content and process domains) in the experimental and control classes. This study shows that problem-based learning with a socio-scientific issue can enhance students' science literacy (see Table 2).

**Table 2.** The result of statistic test on students' science literacy

| Group     | Group      | Normality |            | Homogeneity |             | t test |                             |
|-----------|------------|-----------|------------|-------------|-------------|--------|-----------------------------|
|           |            | Sig.      | Conclusion | Sig.        | Conclusion  | Sig.   | Conclusion                  |
| Pre-test  | Experiment | 0,151     | Normal     | 0,791       | Homogeneous | 0,955  | Not significantly different |
|           | Control    | 0,191     | Normal     |             |             |        |                             |
| Post-test | Experiment | 0,142     | Normal     | 0,720       | Homogeneous | 0,000  | significantly different     |
|           | Control    | 0,058     | Normal     |             |             |        |                             |

The results of this study also show that there is significant difference between students' science literacy in the experimental class and the control class. Enhancing of students' science literacy in the experimental class was higher than in the control class. This shows that problem-based learning with the socio-scientific issue can facilitate students to apply their knowledge on real-life issues. In line with Chin, *et al.* [6] which states that socio-scientific issue can develop students' science literacy. Improvement of students' science literacy in the experimental class is also seen in the domain of content and science processes (see Tables 3 and 4).

**Table 3.** The results of students' science literacy in domain of content science

| No          | Subtopic                           | The question number              | Pre-test (%) | Post-test (%) | N-gain |
|-------------|------------------------------------|----------------------------------|--------------|---------------|--------|
| 1.          | The cause of global warming        | 1, 2, 3, 4, 5, 6, 15, 16, 19, 22 | 18,5         | 25,1          | 0,81   |
| 2.          | The effect of global warming       | 9, 10, 14, 18, 20, 23, 24        | 12,9         | 16,7          | 0,46   |
| 3.          | The solution toward global warming | 7, 8, 11, 12, 13, 21             | 14,2         | 19,1          | 0,57   |
| The average |                                    |                                  | 15,2         | 20,3          | 0,60   |

Table 3 shows that there is an increase in students' understanding of the subject of global warming. Students really understand the subject of the causes of global monitoring compared to other subjects. This is because the context involved in learning is related to phenomena that occur around students. In addition, cooperation between groups and problem-solving activities in the learning process provides meaningful understanding for students. Bilgin, *et al.* [13] states that learning that involves real-life problems can provide meaningful knowledge.

**Table 4.** The results of students' science literacy in domain of process science

| No          | Domain of process science                    | The question number            | Pre-test (%) | Post-test (%) | N-gain |
|-------------|--|--------------------------------|--------------|---------------|--------|
| 1.          | Explain phenomena scientifically             | 2, 6, 9, 13, 14, 18, 23, 24    | 15,8         | 22,4          | 0,78   |
| 2.          | Evaluating and designing scientific research | 7, 8, 15, 19, 20, 21, 22       | 13,6         | 16,9          | 0,38   |
| 3.          | Interpret scientific evidence                | 1, 3, 4, 5, 10, 11, 12, 16, 17 | 17,3         | 21,6          | 0,52   |
| The average |  |                                | 15,6         | 18,5          | 0,56   |

Problem-based learning with the socio-scientific issue can also improve every science process indicator (see Table 4). Indicators explaining phenomena scientifically have the highest increase compared to other process indicators. This means that discussion activities related to sociological issues have a positive impact on students' explanatory abilities. In addition, the involvement of real-life contexts makes it easy for students to make explanations because they are very familiar with the context. The science learning that is supported by a social context will greatly facilitate students in learning science [14,15]. This study also shows that students have difficulty evaluating and designing scientific research. Learning processes that do not involve scientific inquiry activities make students difficult to design and evaluate scientific research. Therefore, learning with a socio-scientific issue will be more effective if the inquiry process is carried out by students independently.

#### 4. Conclusion

This paper has discussed the usage of socio-scientific context in problem based learning to enhance students' science literacy. Based on the results, this study can be concluded that problem-based learning with the socio-scientific issue about Global Warming can improve students' science literacy. Using socio-scientific issue makes it easy for students to make explanations of scientific phenomena. In addition, problem solving activities in the learning process make students able to understand science concepts meaningfully. However, the lack of inquiry activities makes students difficult in designing and evaluating scientific investigations. Therefore, inquiry activities related to the socio-scientific context are very important so that students are more active in scientific inquiry activities.

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