Prosiding SAMSES

by Pinkan Amita Tri Prasasti

Guided experiments book based on SETS (Science, Environment, Technology, and Society) to empower science literacy for elementary school students

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Abstract. Guided Experiment Book based on SETS used a guidebook for students in carrying out scientific work. The SETS-based Guided Experiment Book assists students in developing the skills they possess and familiar with the scientific process for acquiring concepts. Primary school students who have science literacy was expected to apply concepts obtained in school with natural phenomena that occurred in everyday life. The purpose of the research to empower Science Literacy through a SETS-based Guided Experiment Book. The study involved 50 grade V students divided into 2 groups covering 25 students in the intervention group and 25 students in the control group. Activities were conducted over a period of 3 months outside of school activities. The empowerment of science literacy seen from the increased results before and after the SETS-based Guided Experiment Book implementation. SETS-based Guided Experiment Book helped students to empower science literacy through the stages of invitation, exploration, problem-solving, concept application and concluding. These stages were activities that familiarize students to learn concept through the processed and apply environmentally sound technology. Based on the results of research and hypothesis testing can conclude that Guided Experiment Book based on SETS can empower the literacy of science of elementary school students.

1. Introduction

Science learning will train students in improving the competence of understanding the problems faced by a modern society that depend on technology and progress, as well as the development of science [1,2]. The nature of learning science is not enough to just remember and understand the concepts discovered by scientists. However, what is very important is the habituation of the behavior of scientists in finding concepts that are carried out through experiment/practicum and scientific research [3]. The process of finding concepts that involve fundamental skills through scientific experiments can be carried out and improved through practical work in the laboratory [4]. The main purpose of the practicum is to train students to work according to scientific procedures in order to obtain scientific knowledge, skills, and values [5,6]. Practicum activities or experiments become mandatory in teaching science, with this activity students are expected to: 1) Be able to learn science by direct observation of symptoms and scientific processes 2) Can practice scientific thinking skills, 3) Can instill and develop scientific attitudes, 4) Can find and solve various new problems through scientific methods and so on. In addition, guided experiments can help students' understanding of lessons [7]. To help increase students' active

involvement in learning and try to find their own concepts in the learning process, it is practicum activities [8].

The science education process must prepare qualified students, namely science-aware students (scientific literacy). In PISA (Program for International Student Assessment) the results of science literacy (Science Literacy) in Indonesia were not satisfactory, most students considered science to be rote but they did not understand the basic concept. It was found that 61.6% of Indonesian student's science competencies had very good scientific knowledge. Limited or below level 1. While students of that age are expected to be at least at level 2, that is to do simple research. As many as 27.5% are at level 2. At level 3 only 9.5% of students are able to identify scientific problems. At level 4 only 1.4% of students are able to utilize science for life. While at level 6 (highest), no Indonesian student has achieved it [9,10]. Scientific knowledge, its quality, and its production are the underlying elements in scientific educators. Several basic aspects of scientific knowledge and inquiry: scientific knowledge is based on accessible empirical processes; it is subjective and theory-determined; it is not absolute and is constantly changing; it is influenced by human creativity and imagination; and it is influenced by the culture and the society in which the researcher functions [11-14]. Therefore, it is necessary to reverse the practicum guidebook which is separate from the LKS teaching materials in accordance with the indicators, the minimum infrastructure owned by the school and the condition of students. The use of Guided Experiments Book can be varied with a variety of approaches to support student effectiveness, approaches that motivate students so that insight into scientific literacy also increases can be varied with the approach of Science, Environment, Technology, and Society (SETS).

This study has the purpose of empowering scientific literacy through SETS-based guided experiment book by looking at the effectiveness of the use of the book to increase the level of scientific literacy. It is hoped that the application of SETS-based guided experiment books can provide a positive impact (1) students are accustomed to having a comprehensive mindset in viewing science that is integrated with the environment, technology and society; (2) SETS can make students know that technology affects the rate of growth of science, as well as its impact on the environment and society; (3) students are expected to be able to unite the concepts of science that are found through the activities of science process skills, namely practicum activities, and of course can apply the concept based on the environment and technology so that it can be widely used by the community.

2. Method

2.1. Participant

This research begins with testing fifth-grade students in 12 schools in the city of Madiun as one of the prerequisite tests to determine a balanced sample. Based on the results of the initial test, two schools that have the results of the test of scientific literacy skills are normal and homogeneous. The number of students involved in the study amounted to 50 students.

2.2. Material

The instrument used is a science literacy instrument. The science literacy instrument is made based on scientific literacy indicators detailed in Table 1 as follows:

Table 1. Indicator science literacy instrument.

No	Aspects of Scientific Literacy	Indicator	Learning Activities
1	*Science as a body of knowledge*	a) Presenting facts, concepts, principles, and laws. b) Presenting hypotheses, theories, and model models. c) Ask students to remember factual knowledge or information	a) Students observe the problems given by the teacher b) Invite students to identify existing problems. c) Students formulate hypotheses based on problems.
2	*Science as a way of Investigating*	a) Learning students through the use of tables and graphs. b) Teaching students to make calculations. c) Involve students to experiment. d) Use scientific observation and make conclusions. e) Analysis and interpretation of data	a) Students are invited to do practical activities. b) Invite students to write practicum results into tables/graphs. c) Students analyze the results of the practicum and relate it to the relevant theory.
3	*Science as a way of thinking*	a) Describes how a scientist conducts experiments. b) Shows the historical development of an idea. c) Provide a cause and effect relationship. d) Presenting scientific methods and problem-solving Shows skepticism and criticism.	a) Students find solutions to problems that occur in the environment after practicum activities.
4	*Interaction of science, technology, and society*	a) Describe the usefulness of science and technology for society. b) Shows the negative effects of science and technology on society. c) Discuss social issues related to science or technology. d) Science ethics.	a) Students apply the solutions found through simple tool making experiments.

2.3. Procedure

Stage 1 Science literacy test (pretest) is given to the Control Group (CG) and Intervention Group (IG) within 50 minutes. After doing stage 1 students are given learning with ecosystem material. CG learning is applied without using the SETS-based Guided Experiment Book for 5 weeks. Learning tends to be filled with group discussion activities by implementing cooperative learning. In the learning IG, using the help of the Guided Experiment Book based on SETS for 5 weeks the children were active in sharing and applying process science skills. On the 6th-week students enter stage 2. At stage 2 the final test is applied (post-testpost-test) to find out the results of Science literacy that students have after learning activities in CG and IG.

3. Results and discussion

The results of the study presented Science Literacy using SETS-based Guided Experiment Book with. Data that presented the results of Science Literacy were analyzed using descriptive statistical tests on

stage 1 test scores and stage 2 tests [15]. From the results, a t-test was conducted to see the comparison of CG and IG.

Science Literacy data was tested using descriptive statistics on the score of stage 1 test and stage 2 test to find out the description of the values produced before and after doing the learning activities using the SETS based Guided Experiment Book. The test results can be seen in Table 2-5. The results of the assessment based on the average of each aspect of scientific literacy can be seen in Figure 1.

Table 2. Results of science literacy analysis (*Science as a body of knowledge).*

Measure	Stage 1		Stage 2	
	CG	IG	CG	IG
Mean	62.00	60.00	62.21	74.41
95% Confidence Lower Bound	57.03	56.79	58.18	70.25
Interval for MeanUpper Bound	64.97	63.21	74.04	86.92
Median	62.00	60.00	65.00	85.00
Variance	76.80	70.00	72.44	47.67
Std. Deviation	8.76	9.48	5.69	6.93

Table 3. Results of science literacy analysis (*Science as a way of investigating).*

Measure	Stage 1		Stage 2	
	CG	IG	CG	IG
Mean	63.00	62.00	64.37	81.83
95% Confidence Lower Bound	58.74	57.23	59.91	84.43
The interval for Mean Upper Bound	62.18	64.24	70.52	87.28
Median	62.20	61.00	61.28	86.76
Variance	71.80	73.00	56.37	34.62
Std. Deviation	6.38	8.42	3.29	4.53

Table 4. Results of science literacy analysis (*Science as a way of thinking).*

Measure	Stage 1		Stage 2	
	CG	IG	CG	IG
Mean	52.00	67.16	61.11	73.54
95% Confidence Lower Bound	57.03	56.79	51.18	70.25
The interval for Mean Upper Bound	64.97	63.21	72.04	86.92
Median	62.00	60.00	60.10	85.00
Variance	76.80	90.00	62.44	47.67
Std. Deviation	8.16	9.48	8.39	5.33

Table 5. Results of science literacy analysis (*Interaction of science, technology, and society).*

Measure	Stage 1		Stage 2	
	CG	IG	CG	IG
Mean	58.00	46.17	72.11	83.58
95% Confidence Lower Bound	57.03	58.79	58.18	82.25
The interval for Mean Upper Bound	64.97	68.21	80.04	86.92
Median	62.00	62.00	63.00	85.00
Variance	76.80	90.00	64.44	43.37
Std. Deviation	8.26	9.48	8.69	6.72

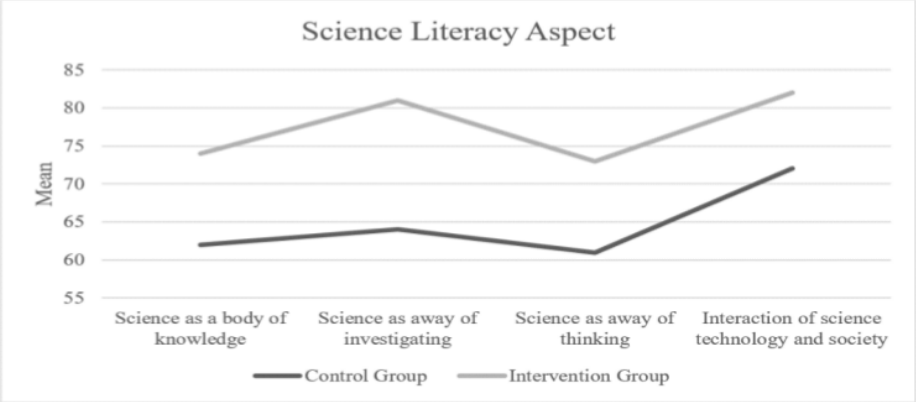

Figure 1. Aspect value of science literacy in CG and IG.

The results of the t-test show that there is a significant difference in mean between IG and CG with the following values:

Table 6. Data analysis.

Group	Test Type	Result	Conclusion
CG	*Kolmogorov Smirnov*	Sig *stage 2*= 0,010	Normal
IG		Sig *stage2*= 0,022	Normal
CG	*Levene's test*	Sig 0.018	Homogen
IG			
CG	*t-test*	t= 3,02p= 0,01	Significant
IG			

The results of the analysis show that there are differences in students' scientific literacy abilities before and after learning. This can be seen from the increasing value before and after the learning activities are carried out and after testing has been carried out there is a high correlation before and after treatment both in the first class and in the second class. This happens because of the ability of students to use scientific knowledge to identify problems and draw conclusions based on evidence in understanding natural changes to make decisions through activities carried out [16,17]. The Guided Experiment Book based on SETS helps students to train their thinking skills to acquire scientific knowledge and attitudes through a series of scientific processes. Through a strong scientific attitude, students are expected to be able to communicate the knowledge and results of research to the general public [18,19]. A person who has scientific literacy is able to use the concept of science, has scientific process skills, to judge in making everyday decisions when dealing with others, society and the environment [20].

Guided Experiments Book based on the SETS approach is expected to have a positive impact (1) students are accustomed to having a comprehensive mindset in viewing science that is integrated with the environment, technology and society; (2) SETS can make students know that technology affects the rate of growth of science, as well as its impact on the environment and society; (3) students are expected to be able to unite the concepts of science that are found through the activities of science process skills, namely practicum activities, and of course can apply concepts that are based on the environment and technology so that it can be widely used by the community [21]. Integrated instruction beginning in the lower grades. They contend that in the early grades there is little expectation for students to read to gather information, even though learning to read is a major focus. In their study they found that beginning readers can and do extend their knowledge by reading from meaningful books: "If children

do not encounter meaningful content in books until the 3rd or 4th grade, the major message they may be learning in the meantime is that reading lacks purpose [22].

4. Conclusion

The results of the study showed that there were significant differences in scientific literacy in CG with IG. The average results obtained by IG showed an increase in stage 2. While the mean CG on stage 1 and stage 2 did not show significant changes. This proves that the use of Guided Experiments Book based on the SETS approach is effective for empowering scientific literacy. In this study, there are certain obstacles in its implementation. When applied to other schools with minimal practicum facilities. The practicum tool is very good for the success of this research, the completeness of the practicum tool can actually be replaced with the use of simple tools, but the problem is the creativity of the teacher to compile is still limited. Need support from various parties to implement scientific-oriented learning in order to empower the literacy skills of elementary school students.

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