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Research paper

The Development of Blog with Nos Within Inquiry Laboratory an Approach for Developing Scientific Literacy of the Student in Junior High School

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Abstract

The era of industry 4.0 requires Indonesia's quality human resources superior, but there are a big problem that many students have low of scientific literacy. Efforts to instill scientific literacy can help students develop an informed conception of the nature of science (NOS) by using a progressive and authentic learning inquiry environment. This research investigate about how is the blog with NOS within inquiry laboratory model that is eligible to develop scientific literacy in science learning of junior high school and the effectiveness of blog with NOS within inquiry laboratory model for developing scientific inquiry. This research is done by 4D Model in Research and Development. The Subject is expert in media and science content, and 68 students of SMP N 9 Yogyakarta. The design of playing field testing is quasi experiment with nonequivalent pretest-postest control group design. The research instruments are the questionnaire of product validation and the scientific literacy test. The data analyze with descriptive qualitative for the validation result and t-test for the scientific literacy test results. The results show that the blogs that produced in this research is eligible as learning media in NOS within inquiry laboratory model. There is a significant difference scientific literacy between before and after learning with and without using blog in NOS within inquiry laboratory model

Keywords: *gamification, arithmetic, dice*

1. Introduction

Almost half of Indonesian high school students (41%) had only limited knowledge of science knowledge. It further revealed that no student can identify, explain, and apply the concept of IPA to more complex living situations on a consistent basis. In addition, Anna Permanasari [1] revealed that there are still about 6.9% of Indonesian students who do not have scientific literacy. In fact, the era of industry 4.0 requires Indonesia's quality human resources superior. Results of research from Widowati, et al [2] showed that junior high school students in the area of Yogyakarta City had the results of analysis of scientific literacy profile SMP Yogyakarta city is still low. Scientific literacy of students on competency aspect is still in enough category with average 51,64. Based on the results of the research, the scientific literacy research on competency aspect is done in SMP Negeri 9 Yogyakarta. The low scientific literacy can be caused by problems in teaching and learning process in the classroom.

These problems can be derived from curriculum, learning and science assessment in Indonesia which prioritizes the content dimension and forgets the context dimensions and processes as required in PISA. The learning process and the instructional model used by teachers in the classroom can be one of the lower factors of scientific literacy. Several countries, including Indonesia, have incorporated implicit scientific literacy in the curriculum. Unfortunately, not all teachers understand how to teach scientific literacy. It also has an impact on the low quality of science learning outcomes which still indicates that science learning process in Indonesian schools still ignores the acquisition of scientific literacy students. In the 2012 Program for International Student Achievement (PISA) survey, out of a total of 65 countries from the surveyed countries, Indonesia was ranked 64th.

Science education is required to provide opportunities to help students develop an adequate conception of science and scientific research should be a sustainable goal in science. Efforts to develop scientific literacy can be realized if education can develop critical, creative, problem-solving, and adaptive thinking skills to develop [3]. Holbrook & Rannikmae state that "the Nature of Science (NOS) comprehension plays an important role in the development of scientific literacy[4]. Efforts to instill scientific literacy can help students develop an informed conception of the NOS by using a progressive and authentic learning inquiry environment. However, the realization of these objectives may be missed because of the inactivity of NOS inquiries [5]. Rahayu states that the insertion of the NOS aspect is expected to have a positive impact on the learner's ability to use science in everyday life that is more focused on scientific literacy skills [6].

According Wenning and Khan [7], inquiry learning is a good way for learners to understand the content of science. Inquiry develops scientific literacy Abrams et al.[8] state Inquiry study is one approach that focuses on the active participation of students in learning, based on scientific inquiry, and based on constructivism. The results indicate that the application of inquiry on science learning has a positive effect on cognitive outcomes, processability, and attitudes towards IPA [9]. In addition, inquiry also provides an opportunity for teachers to explore ideas and experiences to stu-

dents, identify concept errors and direct students using events and logic [10].

One form of application of inquiry learning in the form of learning inquiry lab. Inquiry learning of the laboratory can increase the ability of scientific inquiry and scientific literacy better than conventional learning. Inquiry laboratory is one of the inquiry in Levels Of Inquiry model developed by Wenning [11]. The stages of inquiry learning ranged from the lowest level to the highest level of discovery learning, interactive demonstrations, inquiry lessons, inquiry laboratory (inquiry labs), real-world applications, and hypothetical inquiry.

Literacy of science closely related to inquiry and NOS. Ledderman & Ledderman [12] states that to develop scientific literacy requires an understanding of subject matter, Nature of Science (NOS) and inquiry. What challenges teachers is how to integrate these three aspects or how to teach science using NOS within inquiry laboratory. In this study, the NOS within inquiry laboratory model was completed.

To succeed in the implementation of learning inquiry lab requires the media of learning. In this case the media used in the form of blogs. blog is a web application used by the author to write various types of topics and share information that is available and disseminated online. Blog selected as a supporter of the implementation of NOS within inquiry laboratory learning as an interactive multimedia teaching materials. The advantages of the blog that is reviewed from the ease of maintenance, has more types of widgets. What matters in this research is how the development of the science blogs with NOS within inquiry laboratory worthy of use in science lesson junior high school? Is the use of blogged with NOS within inquiry laboratory can affect the literacy of science students? This study aims to determine the feasibility of blogs with NOS within inquiry laboratory models for use in science learning and investigating its influence on scientific literacy

2. Methods

The 4D model (Define, Design, Develop, and Disseminate) is an option used in research and blog development. Validation of learning device product is done through internal review, external review, limited trial using quasi experiment approach with nonequivalent pretest-postest control group design. The subjects of this study were media experts and material experts, and 70 junior high school students, in two classes namely VII B as experimental class using science-based Nature of Science (NOS) within inquiry laboratory with the help of blog and class VII C with direct learning . The research instruments used are (1) questionnaire validation of material and media experts; (2) a matter of pretest-posttest scientific literacy. Problems developed based on indicators of achievement of scientific literacy on the aspect of competence. As for the grid about the literacy test as in the Table 1.

Table 1: Indicator of scientific literacy aspects of competence

No.	Scientific Competency of Scientific Literacy	Scientific Literacy Indicator	Number of Problem Items
1.	Explain a scientific phenomenon	Recall and apply the scientific sciences according to a particular situation	3
2.	Evaluate and design scientific inquiry	Differentiate questions that are likely to be scientifically investigated Propose a way to investigate the questions given scientifically	4
3.	Interpret data and scientific evidence	Analyze and interpret data and make the right conclusions Identify assumptions, evidence and reasons related to the literature	3

Based on the analysis result using SPSS 16.0 program obtained Cronbach's Alpha value of 0.759 for 9 items. This indicates that the problem is included in the category of high level of reliability. Scientific literacy capability data were analyzed using t-test.

3. Result and Discussion

The results of descriptive research indicate that the scientific literacy profile of junior high school students in Yogyakarta is still low, both for content aspect, competency, and context and attitude. The scientific literacy of junior high school students in Yogyakarta is still low (less than 54) for the three aspects of literacy, and only the attitude aspect that reaches the value of more than 60. This is certainly quite apprehensive considering the scientific literacy is a capability that must be owned by Indonesian young generation to be superior quality. In this study focused on the development of scientific literacy aspects of competence because these aspects underlie students to conduct scientific investigations. In addition, also obtained description of skills inquiry of junior high school students of Yogyakarta (N = 211 students) is still in good enough category. Over 60% of students have good skills to make observation notes and ask questions based on observations. However, because the ability to determine the problem formulation that can be studied is still apprehensive because most (48.34%) lack the ability. These results indicate that junior high school students of Yogyakarta have not been trained to conduct investigations.

Based on the results of the research confirms that the need for the development of scientific literacy students of SMP Kota Yogyakarta is important to be done through inquiry learning. One form of inquiry learning in the form of laboratory inquiry model. Learning model The type chosen is the guided type, which is suitable for untrained students for doing inquiry. The stages or syntax of learning inquiry laboratory that is observation, manipulation, generalization, verification, and application.

Additional NOS within inquiry learning based on the results of the reference review, which states that integration between the inquiry approach and Nature of Science is believed to further optimize the scientific literacy [13]. then the NOS within laboratory inquiry model becomes an option.

One of the selected topics of science is “Environmental Pollution”. These topics have the potential to demand the development of scientific literacy aspects of competence and are taught with an NOS within laboratory inquiry model. In the implementation of such learning, it is important to use appropriate media for science teaching on the topic of Environmental Pollution. Blogs are the right choice, given that the blog or also called "weblog" is a form of web application consisting of writings commonly referred to as posting on a web page [14]. In this study developed a product in the form of science blog with NOS within inquiry laboratory model.

The blog design developed by using blogspot.com which is an online site, easy operation and for free. The inquiry laboratory model contains a series of syntax from Inquiry Laboratory with pre-lab activities and multiple leading questioning that can facilitate learners to find concepts on pollution material through activities in the laboratory and will be loaded with NOS in activities and materials. This Environmental Pollution IPA Blog contains some activities in the form of student worksheet for laboratory experiments and contains material that can be accessed anywhere. The student worksheet provided as many as 3 activities, entitled Identification of Water Pollution, Water Purification, and Air Pollution. The blog view as in Figure 1.

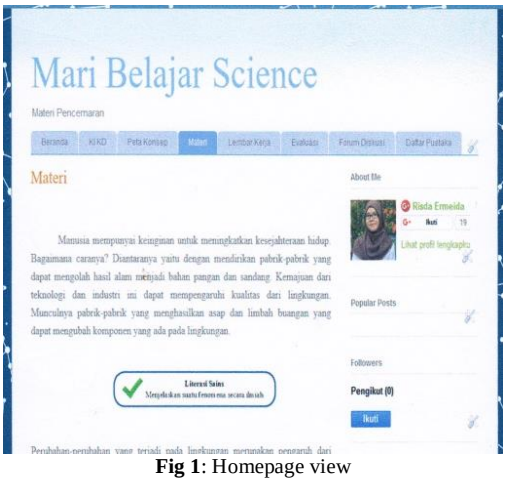

Fig 1: Homepage view

Blogs developed then validated to material and media experts. Based on the validation of media and material experts, qualitative results obtained about blog improvements that include the display of blog pages should reflect the topic, re-review for the order of post menu in the blog so that more systematic, and the inclusion of learning objectives, and settings in the comment field only active on the menu discussion forums so that incoming comments are focused on the discussion forum menu. Furthermore, blogs are improved as suggested by material and media experts. As for the blog display changes as Figure 2 and 3.

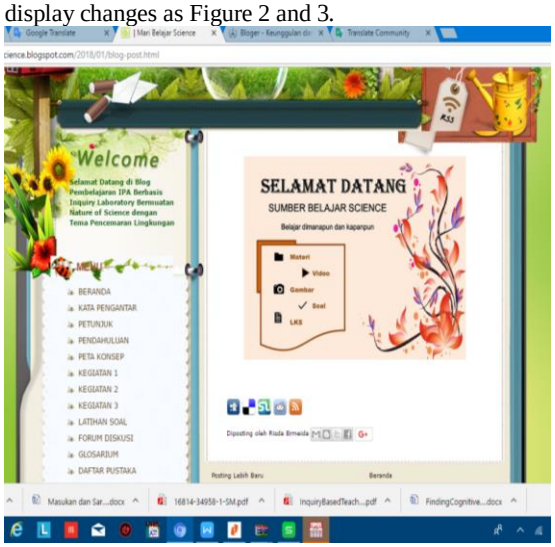

Fig 2: View Blog Home Image after Revision

Fig 3: Blog Page Menu after Revision

The blog as a media interactive is use by blended learning in NOS within inquiry laboratory model. Students can access the science material of learning by using blog and can download the student worksheet. They do the scientific investigation in laboratory by using student worksheet that are attachment in the blog. The blog with the NOS within inquiry lab model developed was then tested limited in experimental classroom learning, and the results were compared with the control class.

Table 2: Descriptives Statistics

Group	Mean		N-gain	Criteria
	Pretest	Posttest		
Experiment	50,72	79,15	0,57	Medium
Control	51,05	73,72	0,47	Medium

Table 2 shows that the increase in scientific literacy aspects of competence in the experimental class is higher than the control class. Homogeneity test and normality test by Kolmogorov Smirnov test using SPSS 16.0 program. The results of homogeneity and normality test data on two classes can be seen in the Table 3.

Table 3: Data Test Results Homogeneity and Data Normality

Group	Data	Homogeneity Test		Kolmogorov Smirnov Test	
		Sig.	Conclusion	Sig.	Conclusion
Experiment	Pretest	0,364	Homogen	0,200	Normal
	Posttest	0,523	Homogen	0,126	Normal
Control	Pretest	0,364	Homogen	0,178	Normal
	Posttest	0,523	Homogenous	0,200	Normal

The result of independent sample t-test between pretest and posttest can be seen in Table 4.

Table 4: Independent Sample t-test

Scientific Literacy	F test		T test		
	F	Sig.	t	df	Sig (2-tailed)
The Second Assumption of the Same Variant	0,413	0,523	2,712	66	0,009

Based on table 5, the value of Sig (2-tailed = 0.009) <½ α (0.05) then H0 is rejected. Thus, there is a difference in the ability of scientific literacy between classes using a NOS within inquiry laboratory-based learning model assisted blogs with classes that use direct learning. The result of the t-paired test between pretest and posttest of scientific literacy as Table 5.

Table 5. Paired Test Result Table

		Paired Differences							
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper	t	df	Sig. (2-tailed)
Pair 1	Pretes Eksp - PostestEksp	-2.843	9.614	1.649	-31.786	-25.07716	-17.243	33	.000

The pretest and posttest values of the experimental class are used to test the hypothesis. Hypothesis test with paired t-test method to know the difference before and after science study based on NOS within inquiry laboratory assisted by the blog to developing scientific literacy in experiment class. The result of paired t-test obtained Sig value. (2-tailed) 0.000 <½ α (0,05), then H0 is rejected and H1 accepted. So there are differences before and after the science learning with NOS within inquiry laboratory model assisted by blogs against scientific literacy in the experimental class. The results of significant differences in scientific literacy ability between control class (direct learning) and experimental class (NOS within inquiry learning laboratory) is consistent with the opinion of Brickman, et al., [15] who applied inquiry in the laboratory to prove that learners have increased scientific investigation ability and scientific literacy better than conventional learning. In addition, it shows that inquiry-based teaching can successfully help students to develop a deep understanding of the knowledge and skills of scientific processes that are essential for the development of student literacy. Other research findings with [16] ques-

tions also encourage student scientific literacy. The NOS in the model makes the model more optimal develop scientific literacy because NOS is an important component of scientific literacy. The blog makes the students take to play an active role constantly by using technology in order to explore and collect information and to discuss their findings.

4. Conclusion

Blog with NOS within inquiry laboratory model is eligible for use in science learning. There is the significant difference of scientific literacy between before and after learning with and without the blog with NOS within inquiry laboratory. There is the significant difference of scientific literacy between before and after study with the blog with NOS within inquiry laboratory.

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