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Effectiveness of Local Wisdom Integrated (LWI) Learning Model to Improve Scientific Communication Skills of Junior High School Students in Science Learning

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Abstract. The previous research has been developed Local Wisdom Integrated (LWI) Learning Model and has been declared that it is valid to improve problem solving skill, scientific communication skills, and environmental care attitude of junior high school students. This study aims to analyze the effectiveness of the LWI Learning Model on improving the scientific communication skills of junior high school students in science learning. This study used one group pre-test and post-test design toward 140 students of junior high school class VII who was divided into 3 groups in SMPN 1 Lingsar and and 3 groups in SMPN 2 Gunung Sari, academic year 2017/2018. The data collection was conducted through questioner, observation, and interview. The scientific communication skills of junior high school students were measured by using scientific communication skills Evaluation Sheet (SCSES). The data analysis technique was done by using paired t-test, Wilcoxon test, and N-gain. The results showed that there was a significant increase in student's scientific communication at $\alpha = 5\%$, with low N-gain and medium category. LWI Learning Model were proved to be effective to improve scientific communication skills of junior high school students in science learning.

1. Introduction

The development of technology led to changes in qualifications and competence of workers to occupy certain positions. Changes in academic performance standards occur along with the development of Information Communication Technology (ICT) and global economic growth [1]. The jobs that involve expert thinking and complex communicative skills has steadily increased since 1960, while jobs with cognitive and manual skills began to decline in the early 1970s [2]. This is supported by the profile of workers' skill needs that the competencies required by current workers are communication skill, productive work in teams and groups, understanding meaning, keen to see business opportunities, self-evaluation and time management and problem-solving skills [2-3]. School education graduates are expected to have job skills such as communication skill, cooperation, problem-solving, entrepreneur, self-defense skill and IT [4]. These competencies are then developed into the 21st century skills.

Communication skill required students to explain valid conclusion based on scientific evidence in solving problems [5]. Communication is a process of exchanging verbal and non-verbal messages between the sender and the recipient of the interplay of messages, so the message belongs together [6-

7]. Science communication emphasizes learning to understand and study the scientific language through the application of learning principles, they are assessing initial understanding, linking facts with conceptual frameworks, metacognitive monitoring, assigning performance, and providing feedback [8]. Undeveloped communication skills cause students to have difficulty in the process of composing thoughts and connecting ideas with other ideas. It will be an obstacle for students to express their ideas. Based on the results of the literature review and the above description, it is necessary to develop a learning that is oriented to the development of 21st century competence, especially on the scientific communication skills.

Research [10] concludes that there are difficulties in assessing skills acquired through PBL, students' difficulties in familiarizing with PBL, difficulty in setting up heterogeneous groups and dealing with competition among students. Inquiry learning can develop students' skills to formulate explanations based on evidence, evaluate scientific explanations, and communicate such scientific explanations problem-solving skills, students' science processes, and analyze opinion [11-19]. Based on some research results above, inquiry is a superior model for learning in school. However, laboratory inquiry is still limited to non-verbal communication skill [20], while the opinion exchange skill of the achievement results is still in low category [15,21]. In addition, it takes a lot of time for observing, drawing, and writing activities [15,22]. Preliminary study results showed the need for innovation-based models of local wisdom that can improve the scientific communication skills of junior high school students.

The basic competence of natural science in junior high school, which is mostly related to daily life, can be used to connect the concept of science and local wisdom. One of them is the seventh grade material on the interdependence relationship in the ecosystem. The tradition of Sasak people in Lombok in the ecosystem preservation is one form of local wisdom that color the life of the community. Referring to the learning models that have been used and the weaknesses, and seeing the importance of integrating local wisdom in learning, it is necessary to develop an innovative learning model that can develop the competence of 21st century students while maintaining the cultural value of the nation. Integration of local wisdom in the learning model is an innovation that provides the widest opportunity for students to be able to achieve the learning objectives as a provision to face the future life while remaining guided by the cultural values of the region. The local wisdom integration-learning model through the environmental conservation values adaptation in the social life of the community, is expected to improve the scientific communication skills of junior high school students.

2. Experiment Method

2.1 General Background of Research

This research was conducted at SMPN 1 Lingsar and SMPN 2 Gunung Sari (Mataram, Indonesia). The scope of this research was a class VII junior high school who take natural science subjects in study year 2017/2018. This research was conducted to analyze the effectiveness of LWI Learning Model through analyzing the improvement of scientific communication skills of junior high school students before and after the application of LWI Learning Model. The effectiveness of the LWI Learning Model is determined based on the statistical significant increase between the pre-test and post-test of the students' scientific communication, and the mean of N-gain that is determined at least on the low improvement criteria.

2.2 Sample of Research

The samples in this study were 140 siswa SMPN 1 Lingsar dan SMPN 2 Gunung Sari (Mataram, Indonesia), which was divided into six groups, they were: group-1 (class VII C SMPN 1 Lingsar), group-2 (class VII D SMPN 1 Lingsar), group-3 (class VII E SMPN 1 Lingsar), and group-4 (class VII B SMPN 2 Gunung Sari), group-5 (class VII C SMPN 2 Gunung Sari), and group-6 (class VII A SMPN 2 Gunung Sari). Each group consisted of students in academic year 2017/2018.

2.3 Instruments and Procedures

The scientific communication skills of junior high school students are measured by using Scientific communication skills Evaluation Sheet (SCSES) [1], which has been declared as valid and reliable

[23]. SCSES includes written communication indicators measured by: 1) the scientific writing, 2) the change of presentation, 3) the knowledge representation, 4) the quality of exposure [1]. The used subject matter in this study was selected in accordance with the local wisdom of the community, and it was the relationship of interdependence in the ecosystem. This study used one group pretest-posttest design, O1 X O2 [24]. The learning began by giving pre-test (O1). Each student was required to complete SCSES. After the pre-test, the teacher applied LWI Learning Model and the learning tool in each group (X). The natural science learning by using LWI Learning Model includes: 1) Identification of problem through the local wisdom enculturation; 2) Local wisdom-based problem-solving activities; 3) Reconstruction of findings through the local wisdom assimilation; 4) Scientific problem-solving result communication; and 5) Evaluation of local wisdom acculturation. Each phase of the LWI Learning Model was designed to train the indicators of scientific communication skills that includes scientific writing, change of presentation, knowledge representation, and quality of exposure. The application of LWI Learning Model was ended by giving post-test (O2). Each student was required to complete SCSES in the post-test.

2.4 Data Analysis
The scientific communication skills of junior high school students are analyzed based on the determined assessment before and after the application of LWI Learning Model. Pre-test, post-test, and N-gain of the scientific communication skills of junior high school students were analyzed by using inferential statistic with the help of SPSS and reinforced by the qualitative descriptive analysis. The score of scientific communication skills of junior high school students is based on the indicators of: scientific writing, change of presentation, knowledge representation, and quality of exposure [1]. The N-gain is determined by using the equation: N-gain = (maximum score-pre-test score) [25], with criteria: (1) if N-gain ≥ .7 (high), (2) if .3 <N-gain <.7 (medium), and (3) if N-gain ≤ .3 (low).

3. Result and Discussion
The learning outcomes of all groups related to the student's scientific communication skills are presented in Figures 1 and Table 1.

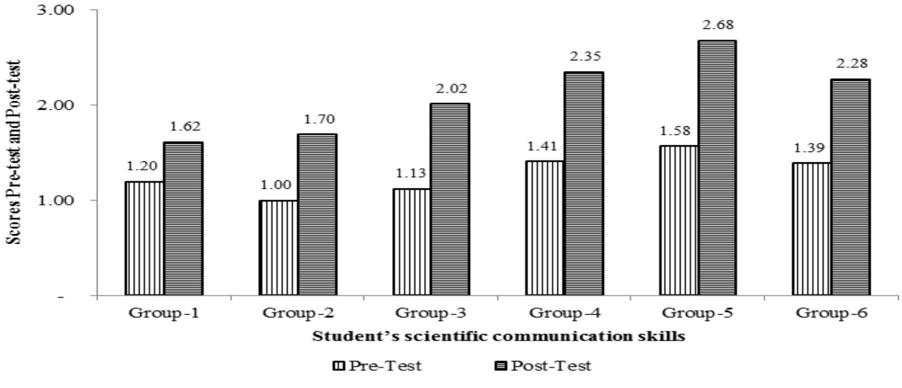

Figure 1: The average pre-test and post-test scores of student's scientific communication skills in all groups.

Vertical bar represent the mean of pre-test and shape bar scores represent the mean of post-test scores. Figure 1 shows that the average pre-test score of student's scientific communication skills for group-1, group-2, group-3, group-4, group-5, and group-6 were respectively 1.20; 1.00; 1.13; 1.41; 1.58; and 1.39. The average post-test score of student's scientific communication skills for group-1, group-2, group-3, group-4, group-5, and group-6 were respectively 1.62; 1.70; 2.02; 2.35; 2.68; and 2.28. Figure 1 shows the average post-test scores of student's scientific communication skills for all groups was greater than the pre-test score. The average pre-test and post-test scores associated with student's scientific communication skills indicators for all groups are presented in detail in Table 1.

Table 1. The average score of pre-test, post-test and N-gain of student's scientific communication skills in all groups.

School	Groups	Scores	Student's scientific communication skills			
			Scientific Writing	Change of Presentation	Knowledge Representation	Quality of Exposure
SMPN 1 Lingsar	**1**	Pre-test	1.25	1.31	1.40	1.69
		Post-test	1.75	2.00	1.58	2.27
		N-gain	.20	.26	.05	.23
	2	Pre-test	.94	1.08	1.25	1.54
		Post-test	1.81	2.31	1.54	2.42
		N-gain	.31	.46	.13	.37
	3	Pre-test	1.25	1.00	1.25	1.86
		Post-test	2.07	2.61	1.91	2.75
		N-gain	.31	.54	.26	.43
SMPN 2 Gunung Sari	**4**	Pre-test	1.53	1.16	1.95	1.74
		Post-test	2.63	2.68	2.47	2.89
		N-gain	.50	.56	.41	.51
	5	Pre-test	1.78	1.55	1.83	1.80
		Post-test	2.88	3.15	3.05	3.05
		N-gain	.52	.70	.80	.59
	6	Pre-test	1.40	1.45	1.78	1.60
		Post-test	2.88	3.15	3.48	2.90
		N-gain	.65	.70	.92	.54

Table 1 shows that the student's scientific communication skills score of each indicator include: scientific writing, change of presentation, knowledge representation, and quality of exposure are low for all groups and the post-test score of student's scientific communication skills in each indicator is medium and high for all groups. The N-gain of student's scientific communication skills score of each indicator includes: scientific writing, change of presentation, knowledge representation, and quality of exposure in all groups are low, medium, and high category. This means that the LWI Learning Model is effective for tracing scientific communication skills in writing. Given these improvements, the LWI Learning Model's characteristics show that students become more motivated to learn, the classroom atmosphere becomes more interactive, emphasizes social interaction among students, the transfer of knowledge can happen and it provides space for students to be creative. This is in accordance with the opinion [26] that communication is essential because someone's success depends on the use of language and communication. The LWI Learning Model has Phase III: Reconstruction of findings through the assimilation of local wisdom has been specifically designed to trace the indicators of scientific communication skills that include scientific writing, change of presentation, knowledge representation, and quality of exposure.

In general, students' scientific writing skills indicator increased. This is related to the learning steps in the LWI Learning Model. The first step begins with the teacher explains a bit of material as an introduction. It aims to provide early knowledge to students before the implementation of the LWI Learning Model. Furthermore, students are given worksheets that contain material, authentic issues and steps to resolve the issue. In groups, students read and write answers to the questions related to the material and in the worksheets. In addition, writing activities can help students to organize thoughts and discover the meaning of a finding for self-reflection and explain it to others; that the writing activities that students do in learning can help them developing the thinking skills. [27-28] The indicators from the change of presentation in all groups showed an increase. This showed that in learning activities students have been trained to organize the observation data into tables and graphs. Conducting a communication by using charts and tables to compose information or observations will make the information pattern becomes more visible, so it can draw conclusions [29]. The indicators of knowledge representation showed an increase in all groups. By presenting the results of observations in the form of tables and graphs repeatedly, then the students are trained the knowledge representation skills. Representation has a role to play in improving the effectiveness of communication, becoming tools to construct ideas, overcoming cognitive impediments, and becoming a bridge between concepts; students will solve problems with good representation; during the learning process, they were also given representations, so that students will be accustomed to solve problems [29,31]. The quality of exposure indicator showed an increase in all groups. The results indicated that LWI Learning Model is able to provide a learning environment that enables students to be actively involved in acquiring and building knowledge during the learning process, as the teacher is able to implement the learning well. This is indicated by activity observation data and student response questionnaire. The response results showed that most students feel that they are able to participate in discussions and issue opinions in the form of answering the questions and giving rebuttal.

Table 2. Paired t-test and Wilcoxon test result of student's scientific communication skills for all groups.

Group	N	Paired t-test				Wilcoxon test	
		Mean	t	df	p	Z	p
1	26	- .41	- 8.45	25	.00		
2	27	- .69	- 9.71	26	.00		
3	28	- .89	- 13.19	27	.00		
4	19	- .93	- 8.38	18	.00		
5	20					-3.92	.00
6	20					-3.93	.00

Note: *p < .05 (2-tailed)

Table 2 shows that the average of student's scientific communication skills for group 1, 2, 3, and 4 is .41; .69; .89; .93 and has degrees of freedom (df) = 25, 26, 27, 18, t score gives t value = -8.45; -9.71; -13.19; -8.38 for group-1, group-2, group-3, and group-4. The score is significant, because $p < .05$. Likewise, in group-5 and group-5 that Z gives the value -3.92 and -3.92 with significance level $p < .05$ so it is significant. Since the results of the calculations are negatively valuable, it is clear that there is an increase in student's scientific communication skills after the application of learning with LWI Learning Model for all groups. The LWI Learning Model has been proven to improve the scientific communication skills of junior high school students. This is because of design in the fourth phase of the LWI Learning Model is communicating the results of problem solving that is designed to emphasize the importance of communication skills in science. In this phase, each group is given an opportunity to present their findings to other groups, and other groups will respond. The interaction can be created by designing learning activities in groups, students are asked to explain to each other [26]. Students will be more interested in learning when they are given the opportunity to pass on their ideas to other students, respond to other students' questions, present evidence against their ideas and evaluate the benefits of exchanging ideas [32]. Face-to-face social interaction among students provides an opportunity for students to share alternative views or ideas, and help students see ideas in different ways. [33] Social constructivist theory explains that learners share individual perspectives with others to build a shared understanding [34]. The results showed that an important strategy to support student participation in communication is group discussion [35]. By developing transferable thinking skills, teachers can help students in building their minds [36], at the time the students perform discussion activities, the process of perception, ideation, and transmission occurs [37]. For the next, peers are effective partners to develop communication skills, because during the discussion process there is no psychological barrier. This is in accordance with the opinion [38], which states that effective scientific communication between scientists and the broader society can enhance the active role of society in scientific activities, scientific attitudes, and scientific treasures.

4. Conclusion

The results showed that there was a significant increase in student's scientific communication at $\alpha = 5\%$, with the N-gain was in low and medium category. LWI Learning Model was proven to be effective o improve the scientific communication skills of junior high school students in natural science learning. The implication of this research is as an alternative solution in improving scientific communication skills of junior high school students through local wisdom-based learning. Further research includes: 1) the need for LWI Learning Model replication to improve the students' scientific communication skills at various levels; 2) local wisdom in other studies needs to be developed in further research.

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