LOCAL WISDOM-BASED LEARNING THROUGH DISCOVERY LEARNING ON SCIENTIFIC LITERACY OF THE ENERGY IN THE LIVING SYSTEM

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LOCAL WISDOM-BASED LEARNING THROUGH DISCOVERY LEARNING ON SCIENTIFIC LITERACY OF THE ENERGY IN THE LIVING SYSTEM

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ABSTRACT:

The research aims to determine the impact of local wisdom-based learning through discovery learning on the scientific literacy in the energy in living system topic. The research is classified as pre-experimental research. The research subjects are class VII IPA at SMP Negeri 3 Gorontalo in the 2020/2021 academic year and involve three classes in class VII IPA in the odd semester of 2020/2021 where one class is opted to be the experimental group, and two others are the replication group. Method applied in this research is pre-experimental with one group pretest-posttest design. The data are collected by applying a scientific literacy test of pretest posttest. The result of hypothesis test in pretest obtains values of t_{count} (-8,89) and t_{table} (152,57) and in posttest obtains values of t_{count} (-42,83) and t_{table} (152,57), and it indicates that H_0 is accepted and $H\alpha$ is rejected. The result of N-gain in every group is that the experimental group and replication group are characterized by high criteria where the experimental group obtains 0.78, replication group 1 obtains 0.79, and replication group 2 obtains 0.79. In conclusion, the local wisdom-based learning through discovery learning model has improved the students' scientific literacy in the energy in living system topic in class VII at SMP Negeri 3 Gorontalo.

Keywords: Scientific Literacy, Local Wisdom, Discovery Learning.

1. INTRODUCTION:

Learning comes about when a teacher is directly conferring material on students, allowing a classroom interaction between the teacher and students. Sardiman (2007:25) is of opinion that achieving learning objectives can be within a learning environment or atmosphere conducive and associated with learning. Students should be active during the learning process because their learning activities constitute the key element to a successful learning process. Therefore, teachers should create a convenient learning environment which can draw student interests. Innovating both learning approaches or models is foreseeable to enhance the learning process and outcome. The most highly used learning model is discovery learning, in which apprehension of paramount structures or ideas of a discipline through students' active engagement in the learning process is stressed. In discovery learning, students are boosted to learn by being actively involved in the discovery of requisite concepts and principles, while teachers should encourage them to have experiences and undertake experiments by which they can find the principles by themselves.

Students learn science at school to broaden their knowledge of science. As elucidated by Wahidin (2006:12), "scientific competency/scientific literacy", by definition, is an awareness of the overall development of information and human civilization. Scientific literate individuals, basically, are not worried about changes. And yet several students perceive changes, inter alia, changes which generate high risks and responsibilities, as daunting. Thus, students are suffering from learning ability constraints. They comprehend basic scientific facts but are unable to communicate and attribute them to real life. Besides, they are facing off difficulties in understanding and applying scientific principles in daily problem-solving. Accordingly, students should be advocated to build self-confidence and induced to read and write scientifically.

As shown in the result of the 2002-2012 research carried out by PISA (Program for the International Assessment of Student), routinely arranged once three years by OECD (Organization for Economic Cooperation and Development), Indonesia, in 2012, was still at the bottom (64th of 65 countries). This showcases that reading interests, learning outcomes, and scientific literacy skills, and competencies of Indonesian people are below the international standard of 500 (OECD PISA, 2006:26).

Learning processes over these years have bored students. They are only instructed to make a material summary and are given lecturing-styled learning, making them passive. Furthermore, teachers are only concerned about students' cognitive and affective learning outcomes. It drives student passivity in learning science and regards the subject as an unpleasant one when science can be learnt in a fun way. One of the learning methods implemented is local wisdom based. Local wisdom-based learning, as described by Prasetyo K. Z. (2013:3), is a conscious effort rigorously designed to dig and leverage local potencies, creating a learning atmosphere and process which motivates students to actively develop their potencies to have skills, knowledge, and attitudes contributing to the nation and state development.

Integrating local wisdom into school learning matters, especially today, when the young generation is showing off less concern about local potencies and wisdom. Most of them are now demonstrating a preference for foreign cultural products over domestic ones. Examples of local wisdom are ubiquitous and can be found around, such as household utensils and toys. As such, we are interested in integrating local wisdom into learning processes. The integration is purposively aimed at escalating student apprehension about scientific phenomena and enabling them to resolve problems using physics concepts. Local wisdom-based learning hence should have valid, effective, and practical learning devices.

2. METHODOLOGY:

This research deployed a pre-experimental method. As explained by Sugiyono (2016:75), the research type was pre-experimental descriptive quantitative with a simple experimental approach using one experimental class and two replication classes. The replication classes were designed to ensure the consistency of the learning outcome attained.

2.1. Research Area:

This research was executed at SMP Negeri 3 Gorontalo Jl. Ir. Yusuf Dalie Kota Tengah Gorontalo City in the odd semester of the

2020/2021 academic year, specifically in December 2020-February 2021.

2.2. Instruments:

In Yuberti and Siregar (2017:119) study, assessment instruments were tools used to collect data. We used tests as the research instruments. The scientific literacy tests in this research were two, i.e.:

1. The initial competency test (pre-test) of scientific literacy, was a test given to students from experimental and replication classes. The purpose of this test was to identify students' initial competencies, either high, medium, or low before the learning process was initiated.
2. The final competency test (post-test) of scientific literacy, was a scientific literacy test given to experimental and replication classes after the local wisdom-based learning model was employed. The purpose of this test was to identify students' problem-solving skill levels.

2.3. Data Collection Technique

A data collection technique constituted a method exerted to collect research data. The data collection technique we exploited was:

2.3.1. Scientific Literacy Test:

As explicated by Norman in Djaali et al. (2008:7), a test was an assessment procedure which was comprehensive, systematic, objective, and the result of which underlain decision-making in a learning process. Some indicators we applied in this scientific literacy test were identifying the scientific issue, explicating the scientific phenomenon, and exerting the scientific evidence.

2.3.2. Teacher and Student Activity Observation:

Teacher activities were observed by Selvi Idrus, S.Pd., a science teacher who taught seventh graders. The observation was performed during the learning process using a teacher activity observation sheet and addressed lesson plan implementation. Meanwhile, student activity observation was undertaken by colleagues, for whom we had provided the format of the observation. The student observer observed each student in each study group using student activity observation sheets. Several student activities observed were their activeness in answering their teacher's questions, interaction with each other and their teacher, and presentation concerning the experiment results, and conclusion-drawing abilities.

2.4. Data Analysis Technique:

Data analyzed were the result of student scientific literacy tests, teacher activity observation, normality test, hypothesis test, and N-gain test. The descriptive analysis data used the following data analysis technique.

2.4.1. Analysis of the Result of Science Literacy Competency Test:

Ali (2013:201) illuminated that scientific literacy competency was defined using the following formula.

$$S = R/N \times 100$$

Where:

S = the score of student scientific literacy competency
R = the number of correct answers
N = the number of question items

The criteria for determining student scientific literacy competency referred to Purwanto (2013:103).

Table 3.5 Criteria for Assessing Student Scientific Literacy Competency

No.	Interval (%)	Criteria
1	86-100 %	Very high
2	76-85 %	High
3	60-75 %	Acceptable
4	50-59 %	Low
5	≤ 54 %	Very low

(Purwanto, 2013:103)

2.4.2. Analysis of Teacher Activity:

Data of the result of teacher activity observation during the learning process were analyzed using the following formula.

$$\text{Aspect percentage} = \frac{\text{The number of aspects acquired}}{\text{Total aspect scores}} \times 100\%$$

In determining the assessment criteria of the result, we made the assessment criteria grouping: very good, good, acceptable, poor, and very poor, as shown off in Table 3.6.

Table 3.6 Teacher Activity Criteria

Activity (%)	Criteria
86-100	Very good
76-85	Good
60-75	Acceptable
50-59	Poor
<54	Very poor

Purwanto (2010:31)

2.4.3. Analysis of Student Activity:

Data of the result of student activity observation during the learning process were analyzed using the following formula.

$$\text{Aspect percentage} = \frac{\text{The number of aspects acquired x the score of each category}}{\text{Total aspect scores}} \times 100\%$$

In determining the assessment criteria of the result, we made the assessment criteria grouping: very good, good, less good, and poor, as shown off in Table 3.7.

Table 3.7 Student Activity Criteria

Score Range (%)	Criteria
86-100	Very good
76-85	Good
60-75	Less good
50-59	Poor

Purwanto (2004:56)

2.4.4. Normality Test:

A normality test was aimed to analyze data and examine whether or not the residual score was normally distributed (Imam Ghazali, 2011:29), and accordingly, determine whether or not the sample data was normally distributed.

We used the Chi-square test here.

$$X^2 = \sum \frac{(fo - fh)^2}{fh}$$

Where:

X^2 = the count normality score

fo = the frequency derived from research data

fh = the expected frequency

We determined X^2_{table} using dk= k-1 at a 5% significance level and decision principles of:

If $X^2_{count} > X^2_{table}$, data were not normally distributed.

If $X^2_{count} \leq X^2_{table}$, data were normally distributed.

(Sugiyono, 2013:241)

2.4.5. Hypothesis Test:

Research hypotheses were tested using factor analysis, to observe if any similarity, balance, or overlapping existed between factors.

The hypothesis test used the two-tailed t-test at a 5% significance level. The associative statistical hypotheses proposed were:

Ho : $\mu_1 = \mu_2$

Hα : $\mu_1 \neq \mu_2$

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The formula used was

$$t = \frac{\overline{X1} - \overline{X2}}{s\sqrt{\frac{1}{n_1} + \frac{2}{n_2}}}$$

with:

$$S^2 = \frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}$$

$\alpha = 0.05$

Ho was accepted if $-t_{1-1/2\alpha(n1+n2-2)} < t < t_{1-1/2(n1+n2-2)}$

Where:

$\overline{X1}$: the mean of sample 1
$\overline{X2}$: the mean of sample 2
n_1 : the number of sample 1 data
n_2 : the number of sample 2 data
s_1 : standard deviation of sample 1
s_2 : standard deviation of sample 2

Sudjana (2005:239)

2.4.6. N-gain Test:

As lain out by Herlianti (2016:70), the N-gain test focused on investigating the augmentation of student cognition through learning. We used the direct instruction learning model applied to deliver the simple plane material. The normalized gain (N-gain) was calculated using the following formula.

$$N - Gain = \frac{\text{Posttest score} - \text{Pretest score}}{\text{Ideal score} - \text{Pretest score}}$$

Table 3.8 N-gain Score Category

Score Range	Description
(0.71< g < 1.00)	G-high
(0.31 < g < 0.70)	G-medium
(g < 0.30)	G-low

(Hake in Herlanti, 2015)

2.5. Data Validity:

Instrument validity used in this research was construct validity. Sugiyono (2016:177) set forth that in construct validation, judgment experts were used. Accordingly, aspects measured using certain theories were constructed and consulted with experts. The instrument used was a scientific literacy test. The validity test presented question items validated by experts (examining lecturers), who also afforded recommendations to fix research instrument items comprising the outline, questions, and a marking scheme.

3. RESULTS AND DISCUSSION:

3.1. Results:

The research area was SMP Negeri 3 Gorontalo. Seventh graders (class A, B, and C), on account of their activeness, were chosen and researched. Each class consisted of 25 students. We implemented local wisdom-based learning using the discovery learning model to elevate student scientific literacy, especially of the Energy in the Living System material. In this learning material, students were expected to make tools commonly used by the Gorontalo community and toys used by the community in the past. Additionally, students were instructed to carry out a photosynthesis experiment by examining plants in a dark and light room and an anaerobic respiratory experiment on an inflated balloon using yeast. The experiment result should be presented and sent to the WhatsApp group.

Research data were elicited by studying teacher and student activities during the learning process using tests. The tests covered questions proposed to gain data of student scientific literacy in connection with the Energy in the Living System material delivered through local wisdom-based learning in three meetings to each class. Student scientific literacy was assessed using an objective scientific literacy test containing 24 question items, half of which were conferred on the pre-test, and the other half was given on the post-test.

3.1.1. Student Scientific Literacy Test Result:

Three indicators were exerted in the student scientific literacy test conducted on students in classes A, B, and C. They were indicator I: identifying the scientific issue, indicator II: explicating the scientific phenomenon, and indicator III: exerting the scientific evidence. Students were tested for their scientific literacy before and after treatment (a pre-test and a post-test, respectively). The two tests focused on analyzing the effect of local wisdom-based learning through the discovery learning model.

Most students had very low pre-test scores. However, after being treated with local wisdom based learning through the discovery learning model, they achieved very good learning outcomes.

3.1.2. Teacher Activity Observation Result:

The teacher activity observation was executed by an observer, i.e., the science teacher who taught students of the classes researched. Teacher observation was performed in three sessions for each class. In the first meeting, the material rendered was Energy, whereas, in the second and third ones, the focal materials were Photosynthesis and Respiration, respectively. The result demonstrated that the discovery learning model was well applied and the teacher activities were considered very good and good.

3.1.3. Student Activity Observation Result:

Student activity observation was performed by filling student activity observation sheets, inquiring about nine aspects observed by our colleagues during the learning process. The student activities in the three classes were good but some aspects were still considered acceptable on meeting I and II. This exhibited that students had not been accustomed to local wisdom-based learning through the discovery learning model for scientific literacy.

3.1.4. Normality Test:

a. Data from the Pre-test:

Table 1 Data Normality Test Result

Class	X^2_{count}	X^2_{table}	Description
Class A	-48,507	11.070	Normally distributed
Class B	-56,726	11.070	
Class C	-41,981	11.070	

b. Data from the Post-test:

Table 2 Data Normality Test Result

Class	X^2_{count}	X^2_{table}	Description
Class A	-42,684	7.815	Normally distributed
Class B	-64,445	7.815	
Class C	-53,604	7.815	

3.1.5. Hypothesis Test:

A hypothesis test vested an examination of whether local wisdom-based learning through the discovery learning model implemented in the experimental and replication classes affected the student science literacy. Based on the pre- and post-tests hypothesis test using a criterion of $-t_{1-1/2\alpha(n1+n2-2)} < t < t_{1-1/2(n1+n2-2)}$, the pre-test t-test was -152.57 < -8.89 < 152.57 and the post-test t-test was -152.57 < -42.83 < 152.57. Accordingly, Ha was accepted.

3.1.6. N-gain Test:

Table 3 N-gain Test Result

Class	Mean Pre-test Score	Mean Post-test Score	N-gain	Criterion
Experiment	33.4	86	0.78	High
Replication 1	31.6	86.2	0.79	High
Replication 2	32.8	87	0.79	High

3.2. Discussion:

The research subject population was the seventh graders who were reduced to three sample groups consisting of an experimental class (Class A) and two replication ones (Classes B and C). WhatsApp, Google Form, and Google Meet, three applications students were familiar with and often used by teachers, were used

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here. The learning process was carried out online, and the three sample groups were administered the same treatment. From the normality test, we got normally distributed data. We investigated if there was a positive effect of the treatments administered to the experimental and replication classes on student scientific literacy. From the hypothesis test, $-t_{1-1/2\alpha(n1 + n2-2)} < t < t_{1-1/2(n1 + n2-2)}$ at $\alpha = 0.05$. Hence, H_0 was accepted and $H\alpha$ was rejected. An N-gain test was conducted to glean the score from student scientific literacy augmentation activities. The experiment class procured a score of 0.78 at a high criterion, whereas the scores of the replication classes 1 and 2 were the same, which was 0.79 at a high criterion. Nevertheless, as local wisdom-based learning was seldom applied, students had few ideas of local wisdom from their area, notably Gorontalo. By implementing local wisdom-based learning, students were able to apprehend the local traditions and were motivated in learning using local wisdom-based toys. This is in correspondence with Ridwan N. A. (2007:7), that local wisdom embodied to be traditions and cultures and was reflected by values applicable in a certain community group.

Scientific literacy was determined by three scientific competencies, which were identifying the scientific issue, explicating the scientific phenomenon, and exerting the scientific evidence. From the result of the local wisdom-based pre-test given before treatment, the experimental class had a mean percentage of 29%, while the replication classes 1 and two had 27% and 28%, respectively. The three classes' score percentage range was 27%-29%, which was considered very low. Moreover, from the result of the local wisdom-based post-test given after treatment, the experimental class had a mean percentage of 84%, while the replication classes 1 and two had the same one, i.e., 85%. The score percentage range of the three classes was thus 84%-85%, which was considered good. That being so, building on the pre- and post-test results, the three classes had very low score percentages before treatment and good ones after treatment.

Students made significant progress in regard to scientific literacy after being delivered with local wisdom-based learning through the discovery learning model. It is in line with Khasanah et al. (2016:384), that the discovery learning model was effective for enhancing student scientific literacy competency. The pre- and post-tests were given to identify student scientific literacy progress, particularly in the Energy in the Living System material. The hypothesis test result indicated that local wisdom-based learning had a positive effect on student scientific literacy. Lestari (2017:103-106) shed light on her research finding that scientific literacy had a positive impact on student cognitive competencies. Correspondingly, Haristy et al. (2013) spelt out that scientific literacy-based learning influenced student learning outcome escalation. The arguments pointed out that scientific literacy could improve student learning achievements.

4. CONCLUSION:

Based on the result, we drew a conclusion that local wisdom-based learning through the discovery learning model for the Energy in the Living System material increased the scientific literacy of the seventh graders at SMP Negeri 3 Gorontalo. From the hypothesis test (t-test), H_0 $-t_{1-1/2\alpha(n1 + n2-2)} < t < t_{1-1/2(n1 + n2-2)}$ was accepted at a 0.05 significance level. Building on the pre-test and t-test, the t_{count} was -8.89 and t_{table} was 152.57 at a criterion of $-t_{1-1/2\alpha(n1 + n2-2)} < t < t_{1-1/2(n1 + n2-2)}$ or $-152.57 < -8.89 < 152.57$, and from the post-test and t-test, the t_{count} was -42.83 and t_{table} was 152.57 at a criterion of $-t_{1-1/2\alpha(n1 + n2-2)} < t < t_{1-1/2(n1 + n2-2)}$ or $-152.57 < -42.83 < 152.57$. Predicated on the quantification, H_0 was accepted. The N-gain test results of the three classes, i.e., an experimental class and two replication ones were high, in which the experimental class acquired 7.8, whereas the replication class 1 and 2 acquired the same, which was 7.9. Local wisdom-based learning through the discovery learning model, therefore, had an effect on the seventh graders' scientific literacy of the Energy in the Living System material at SMP Negeri 3 Gorontalo.

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