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Student Literacy Competence in Science Learning in Junior High Schools with the Reading to Learn Model

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ABSTRACT

The current era of globalization has succeeded in creating various problems and challenges of human life. The ability to solve problems and challenges of life is very necessary. The place for education, especially science, is the main key so that citizens are able to live their lives well. The phenomenon of the low mastery of integrated science content of students at the basic education level cannot be separated from the dimensions of their literacy attitude. These dimensions include the application of science, knowledge of science, the process of science, and patterns of behavior towards science. The aim of this study was to describe the scientific literacy skills of students in learning with factual texts. The type of research used is descriptive qualitative research. A total of 40 students were used as sources of information to view and obtain a literacy competency profile in science learning. Data were collected through observation and tests through a number of questions to obtain information on the dimensions of students' literacy attitudes. The research finding is that there is an increase in learning progress based on the results of the pretest and posttest with a difference of 15.8 points for the overall PISA competency aspect. The competence aspect of explaining scientific phenomena obtained the lowest average result, while the competence aspect of evaluating and interpreting the data obtained a higher average result. Thus, it can be concluded that the implementation of science learning in schools should be more meaningful for students so that they are able to have higher literacy skills, especially scientific literacy. This can be achieved by applying holistic and integrative learning in science learning.

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1. INTRODUCTION

One of the most important subjects at the junior high school level is science (Natural Science, IPA). Developments in the era of globalization can be overcome by providing students with science knowledge. Solving science problems can be solved by integrating concepts in factual texts covering texts related to chemistry, physics, biology, and earth and space. In addition, language skills are needed to be able to communicate science phenomena (Lia, Zulkardi, & Wiyono, 2021) and the findings of the evidence. This learning process is also known as integrated science learning. Indonesian scientific literacy still occupies the lowest rank with a score below the PISA score (Widiyawati, Nurwahidah, Sari, Masykuri, & Budiyanto, 2021). One of the reasons why students' logical thinking skills have not been maximized is the lack of a learning process that provides problem-solving or is only limited to theory so that when given real problems, students will have difficulty thinking logically (Monita, Mona & Fitria, 2021);(Amini & Sinaga, 2021). One of the abilities that must be possessed by students who will become teachers and teach science learning to students is the ability to think logically. So that when the teacher already can think logically, they can ask questions that invite students to think logically.

The low scientific literacy of students is evidenced by the results of several scientific studies. The lack of teacher creativity in providing material aspects of science and the process of science in the learning process in the form of factual texts causes students to memorize or without understanding a concept (Yuliati, 2017). Added by Laslo and Baram that the target of learning science is to get high or good school exam scores, not because students feel that science learning needs to be learned to be able to face problems in everyday life (Laslo & Baram-Tsabari, 2021). The pattern of science learning that does not change or only targets improving test results makes students' scientific literacy skills low (Agustin & Supahar, 2021). No research has been found that focuses on the process of learning activities of higher-order thinking in science learning oriented towards literacy activities. Literacy learning activities are initiated by providing factual texts and analyzing factual texts for students to construct scientific knowledge. Construction is done when students analyze word by word, sentence by sentence in one paragraph to find scientific terms, scientific concept terminology, and procedures in science.

The findings above must be addressed or changed so that science learning becomes meaningful so that aspects of attitude, content, process, and context can be achieved (NASEM, 2016). Improvements and changes in science learning are guided by the PISA assessment of scientific literacy (OECD, 2007). Learning science that integrates concept analysis and analytical skills in a real-world context will improve problem-solving skills in the end students can understand the scope of the material being studied. The success of scientific literacy is determined by the teacher who plays a role during the learning process (Roberts, 2013). Because the teacher makes the planning of the learning process and implements it so that it can be an alternative to solve the problems above. Students can be invited to master their scientific literacy skills in the fields of attitude, content, process, and context as a teacher's effort to improve scientific literacy in schools (Yore, Bisanz, & Hand, 2003); (Adnan, Mulbar, Sugiarti, & Bahri, 2021).Scientific knowledge is structured on facts, concepts, principles, theories, and laws. All of this is obtained through creative stages with certain systematics to prove and fulfill human curiosity that takes place throughout the life process. Patterns of regularity and mutual integration between various supporting elements make students able to construct knowledge in a meaningful way. Integrated science learning invites students to have meaningful and real skills. Therefore, science must be continuous with the real conditions of students, so that the scientific knowledge possessed by students increases significantly. A rich learning experience with an analytical process can be obtained by students when studying science (Fitria, 2014). This is in line with Agustiani's opinion that elementary school teachers still rarely develop formal scientific competencies, scientific competencies must be possessed by teachers so that they can apply a scientific approach when studying as a support for their scientific competence (Agustiani, Rustaman, & Wulan, 2020). The learning process that prioritizes interactive, inspiring, fun, and challenging activities will stimulate students to always be active in learning and can facilitate students so that they can increase their creativity and learn independently by

the basic potential that students have been born with, including student intelligence (Kemendikbud, 2017).

The ability of students to interpret language, symbols, or literacy skills is called literacy. The meaning of literacy in the field of science is the ability of students to understand, be able to think, and be able to apply a scientific perspective, and be able to apply concepts in their lives. The results of research using scientific methods that improve logical thinking skills so that the discovery of natural science is a complete understanding of science learning including the scientific process and skills in making decisions to participate in the context of life regarding economic and cultural aspects (Abidin, 2014); (Bybee, Mccrae, & Laurie, 2009);(Deswari, 2015). The use of science in identifying and proving facts when interpreting the universe with events experienced by humans is called scientific literacy according to PISA. Students not only master knowledge but can use it in the dimensions of social life, issues, and cultural change in the scientific community. Students practice respecting collective views of what it means to do science, of how to think, communicate and argue in the beliefs and language of science. (Sammel, 2014); (Lestari, 2018).

An important understanding of the characteristics of scientific knowledge as an important aspect of scientific literacy, and addressing socio-scientific issues often trigger debate, therefore an understanding of the meaning of scientific nature is needed. People who can survive in the face of fast-paced social life with changes in lifestyle are those who are scientifically literate. The point is that scientific literacy is related to skills, having understanding and knowledge, and being able to internalize scientific values in the scans themselves (Sengdala & Yuenyong, 2021); (Sarifah Sihotang, 2015); (Huryah, Sumarmin, & Effendi, 2017). Knowledge of attitudes, understanding and scientific processes is the core of the development of scientific literacy. The science here does not only know the concept of science but can apply scientific abilities to solve various problems and can make decisions based on various scientific considerations (Lia & Wiyono, 2021). Therefore, students are required to be able to apply the knowledge gained at school in their daily lives, so that students are sensitive and care about the environment in which they live. The three major dimensions of scientific literacy according to PISA 2000 and 2003 measurements are context, content, and process (Agustiani et al., 2020).

PISA 2006 stipulates four dimensions of scientific literacy, namely 1) content dimension (science knowledge), 2) process dimension (scientific competence), 3) context dimension (science application) and 4), student attitude dimension to science (Fitria, 2017). The four dimensions of scientific literacy should be a consideration for teachers in implementing literacy-based learning so that students' literacy skills can develop optimally. Meanwhile, PISA 2018 emphasizes the achievement of three literacy competencies, namely; (1) Explaining phenomena scientifically; (2) evaluating and designing scientific inquiries; and (3) Interpreting data and evidence scientifically (OECD, 2018). Thomas explained that scientific methods, scientific knowledge, and understanding norms are the relationship between scientific literacy and knowledge (Shwartz, Ben-Zv, & Hofstein, 2005). The attitude of science is that scientists are literate on new ideas, honest, consistent, and have a responsibility to their knowledge so that it becomes an added value to the habits of scholars (Tursinawati, 2016). The importance of scientific literacy is because it is a basic competency for students when interpreting aspects of life.

Solving key problems in a factual text that is fully available in learning is a major part of the analytical thinking process. Although the stimulus in the form of text information provided has never been known to students, if they have good initial analytical skills, they can still relate the various information to state something. (Kuswana, 2012; Johnson, 2014). If the learning process has not been able to bring up this ability, that is the cause of the low literacy attitude. In addition, analytical skills stimulate students to be able to understand things from the point of view of others so as to foster an attitude of empathy; (Wellington, 2009).

2. METHODS

The purpose of this research is to describe the implementation of HOTS literacy learning using the R2L model. A total of 40 third-grade junior high school students in the city of Padang Panjang were

used as research subjects. Data collection was carried out qualitatively and quantitatively by using observation instruments and calculating the average number of instrument entries. Documentation is carried out as evidence of implementation activities. All teacher-student activities and student interactions with learning resources are evidence of information records in data collection (Sukmadinata, 2009; Moleong, 2014). This research was carried out by observing for two months in 2021 by collecting data, processing it, and then describing the results found. Scientific literacy ability was measured using tests on science knowledge and science applications. Science attitudes and processes were measured by field notes and observation sheets. The data was found, recorded, and collected based on photos and video documentation. The data were analyzed by sorting only the important information related to the R2L model HOTS literacy learning stages, namely, reading academic texts with understanding, identifying key information in a text, taking that information out using notes, use this information to write their own texts. Learning observations were made for each stage. The teacher's initial step is to prepare factual reading texts, the second step is that the students and the teacher identify key information in the text, and the third step is that students are asked to reprocess key information into new information according to the content of the text, and the last step is that students are asked to make new texts from key information. marked with students and teachers. The literacy test was given before and after the implementation of the literacy HOTS learning. The test results were analyzed using the percentage formula using the criteria very good (score 80-100), good (score 66-79), quite good (score 56-65), not good (score 40-55), very poor (score 30-55). 39) (Arikunto, 2009; Sugiyono, 2012).

3. FINDINGS AND DISCUSSION

3.1. Findings

The quality of human resources and the quality of education can be improved by learning science (Fitria, 2017). The essence of science learning is the continuity of the educational (Fitria, 2014). Science is a place to improve the arts and science of technology (Monita, Mona & Fitria, 2021). The research that has been carried out at the junior high school has implemented the 2013 curriculum using the stages of HOTS Literacy learning in science learning for two months. Researchers analyzed students' scientific literacy skills, through observation activities carried out from October - to November 2021. The analysis focused on the achievement of the standard aspects of measuring scientific literacy according to PISA, namely context, knowledge, and attitudes. The results obtained are described as follows.

Before learning begins, students are given a pretest to get initial information on students literacy HOTS abilities. The results of the implementation class pretest are presented in Table 1 below.

Table 1. Implementation Class Pretest Results

Information	Implementation class pre-test
Total students	40
Number of questions	25
Mean	56,1
Median	60
Standar Deviasi	15,49
The Lowest Value	28
The highest score	96

Pretest data before the implementation of literacy HOTS learning was given treatment, the lowest score = 28 and the highest value = 96, with standard deviation = 15.4, median = 60 and average value = 56.1. This result is obtained from the pretest score of 40 students who will then be given treatment with the R2L learning method based on HOTS literacy.

Determine the group of students by looking at the average value plus the standard deviation. Average value = 56.1.

Standard Deviation = 15.4

X = Mean Value + Standard Deviation

X = 56.1 + 15.4 = 71.5

With X = value that must be achieved by students for the criteria for high literacy ability.

Table 2. Frequency of Student Ability Criteria based on Pretest results

Criteria	Amount	Percentage
High	5	12,5 %
Medium	16	40%
Low	19	47,5%
Total	40	100%

From Table 3. It can be seen that in the implementation of the pretest students with low literacy levels were 19 people with a percentage of 47.5%, students with moderate literacy levels were 16 people with a percentage of 40%, and students with high literacy skills were 5 people. with a percentage of 12.5%. The results of students' scientific literacy skills prior to implementation based on PISA competencies are presented in Table 3 below.

Table 3. Pretest results based on PISA competencies

No	PISA Competencies	Number of Questions	Question Points	Score
K I	Explain phenomena scientifically	9	2, 5, 6, 8, 11, 12, 16, 20, 21	20,3
K II	Evaluate and Design Scientific enquiry	7	1, 3, 13, 14, 15, 24, 25	21,4
K III	Interpret data and evidence scientifically	9	4, 7, 9, 10, 17, 18, 19, 22, 23	25,6

In more detail, the results of the pretest are presented in Figure 1 as follows:

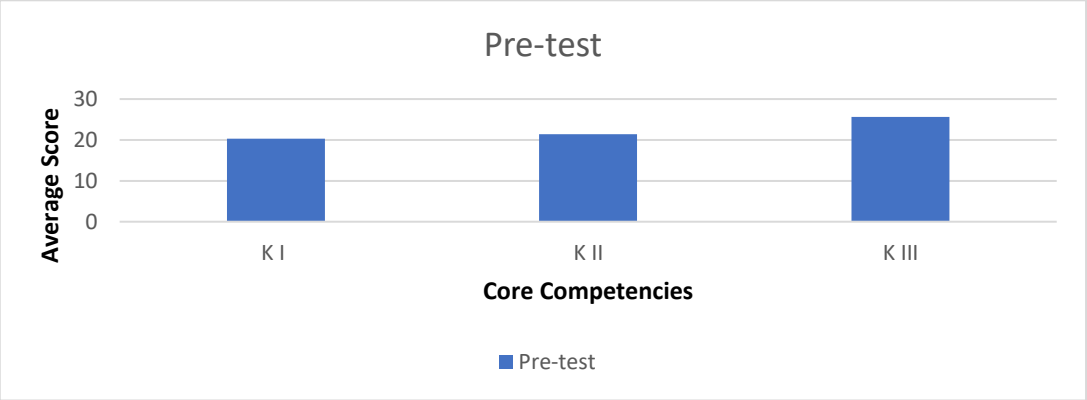

Figure 1. Pretest results

The graph shows that the scientific literacy competence/ability of students in explaining phenomena scientifically gets a score of 20.3, students' literacy skills in evaluating and designing scientific investigations get a score of 21.4, while students' literacy skills in interpreting data and scientific evidence get a score of 25.6.

Then after the data obtained from the results of the pretest in the experimental class will then be given treatment in the form of learning with the Reading to learn method based on HOTS literacy. To find out whether there was an increase in students' literacy skills after being given treatment, a posttest was carried out, following the results of the posttest from the implementation class.

Table 4. Implementation Class Posttest Results

Information	Implementation class pre-test
Total students	40
Number of questions	25
Mean	71,9
Median	72
Standard Deviation	11,00
Lowest score	48
highest score	100

The experimental class posttest data after being given treatment got the lowest value = 48 and the highest value = 100, with standard deviation = 11.00, median = 72 and average value = 71.9. These results were obtained from the posttest scores of 40 experimental class students who would then be given treatment with the R2L learning method based on literacy HOTS. The results of students' scientific literacy skills after implementation based on PISA competencies are presented in Table 5 below.

Table 5. Posttest results based on PISA competencies

No	PISA Competencies	Number of Questions	Question Points	Score
K I	Explain phenomena scientifically	9	2, 5, 6, 8, 11, 12, 16, 20, 21	27,44
K II	Evaluate and Design Scientific enquiry	7	1, 3, 13, 14, 15, 24, 25	29,28
K III	Interpret data and evidence scientifically	9	4, 7, 9, 10, 17, 18, 19, 22, 23	29,44

In more detail, the results of the pretest are presented in Figure 2 as follows:

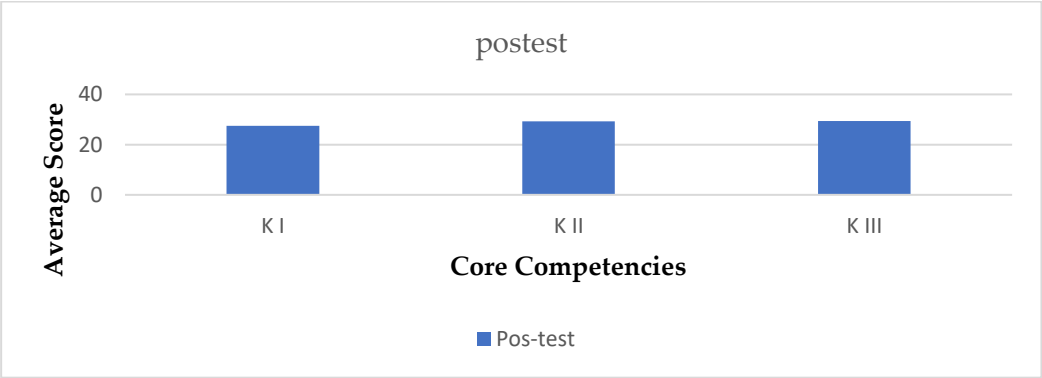

Figure 2. Posttest results

Based on the graph, it can be seen that the literacy ability of students after being treated with the HOTS Literacy-based R2L learning method in explaining scientific phenomena got a score of 27.44,

students' literacy ability in evaluating and designing scientific investigations got a score of 29.28, while students' literacy skills in interpreting data and evidence scientifically got a score of 29.44.

Then after the data obtained from the pretest and posttest results, a comparison of students' literacy skills scores according to PISA competencies was carried out by comparing the pretest score graph with the posttest score graph. The following is Figure 3 comparison of pretest and posttest scores according to PISA competencies.

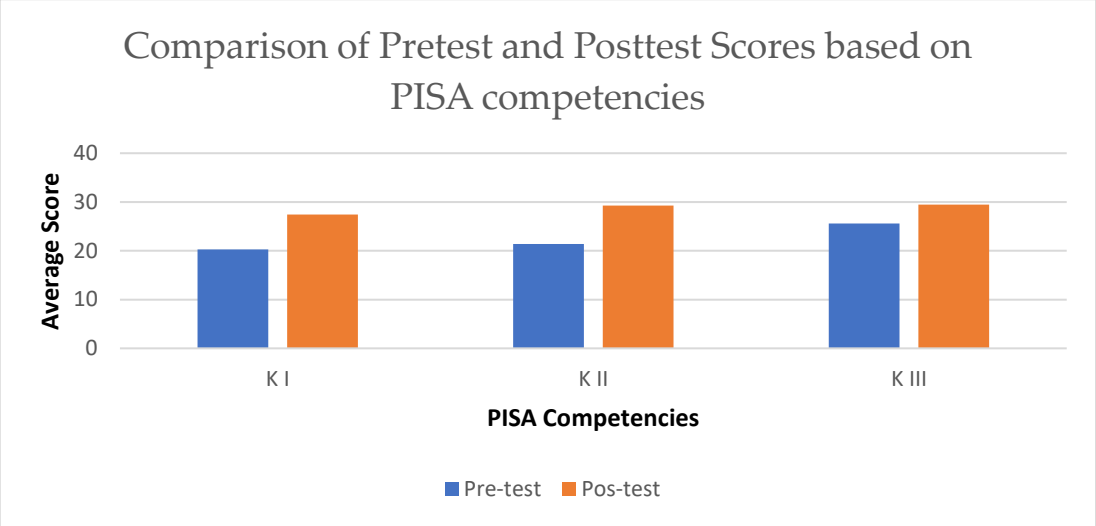

Figure 3. Posttest results

Based on the graph, it can be seen that the literacy ability of students after being treated with the HOTS Literacy-based R2L learning method in explaining scientific phenomena got a score of 27.44, and students' literacy ability in evaluating and designing scientific investigations got a score of 29.28, while students' literacy skills in interpreting data and evidence scientifically got a score of 29.44.

Then after the data obtained from the pretest and post-test results, a comparison of students' literacy skills scores according to PISA competencies was carried out by comparing the pretest score graph with the post-test score graph. The following is a Figure 3 comparison of pretest and post-test scores according to PISA competencies.

Figure 3. Comparison of pretest and posttest scores of students' scientific literacy competence

From the graph above, it can be seen that there is an increase in the score of students' scientific literacy skills after being given treatment in the form of reading to learn based on HOTS Literacy. The data on increasing students' scientific literacy skills are used to determine students' scientific literacy skills after being given treatment by looking at the average value of N-gain. The following data shows the average value of pretest, posttest, and N-gain.

Table 6. Average data of pretest, posttest, and N-gain

Average pre-test	Average post-test	N-gain average
56,1	71,9	0,36

Based on Table 6. it can be seen that the average Ngain obtained after calculating is 0.36 in the medium category.

3.2. Discussion

Reading skills are needed for science narrative texts and being able to apply them. Students are trained in the skills of understanding special terms and phrases related to science, terms that have different meanings when used in the science process, interpreting scientific symbols and diagrams, recognizing general patterns in science texts, using deductive and inductive reasoning skills, and

summarizing ideas. the main and make implicit conclusions, conclude the sequence of implications and causal relationships, and recreate the structure of the text that is not the same as the initial text that is read. The mental pressure for science educators is that student's motivation to learn through reading science texts always decreases. Scientific literacy is of great interest to science educators because the assessment of students' conceptions of various important concepts in science is very important for many learning (Dori & Tal, 2001). Therefore, it is very important for teachers to always connect reading assignments with students' real-world experiences. Students will get hands-on experience from reading science texts, and practicing appropriate reading strategies will improve their achievement.

The implementation of literacy HOTS learning with the R2L model provides student learning progress with an increase in literacy skills according to PISA competence of 15.8 pounds with the achievement of N-Gain at a moderate level. This means that HOTS Literacy learning is very good in awakening the potential of students to be able to process thoughts, understand and analyze reading based on text. There is a construction process by students in finding keywords and understanding their meanings. Thus meaningful learning occurs, and students can convey key concepts of science knowledge after two weeks of learning even though the learning experience is not familiar to them. This finding can be seen in the results of the pretest with an average score of 56.1. This value is obtained from the results of students when doing the first test (pre-test) where students have not received learning treatment with the HOTS literacy-based reading to learn learning method. After students get treatment, the final result or post-test increases moderately with an average value of 71.9.

4. CONCLUSION

Very good for improving student competence when solving problems and addressing existing issues. Based on the results of the study, it was proven that they succeeded in changing and improving their competence. The research findings are that the progress of students' learning with literacy HOTS learning using the R2L model can show the development of scientific thinking attitudes as seen from the data, the increase in the average pretest to post-test score is 15.8 points and is in the N-gain category with moderate criteria. This shows that literacy HOTS learning if implemented on an ongoing basis will provide a change in the character of a higher quality generation. With the training of higher-order thinking skills and the habit of reading and processing information properly, there will certainly be many people who are innovative, creative, critical, and able to make wise decisions. Thus, it can be concluded that the implementation of science learning in schools should be more meaningful for students so that they can have higher literacy skills, especially scientific literacy. This can be achieved by applying holistic and integrative learning in science learning. For this reason, teachers are strongly encouraged to implement literacy learning with this reading-to-learn model. And to other researchers to test this model for other science topics. The limitation of the research is that the research was conducted in the Padang Panjang area so it cannot be concluded that the scientific literacy ability of students in a larger population is not yet possible.

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