JPPIPA 9(8) (2023)

Jurnal Penelitian Pendidikan IPA

Journal of Research in Science Education

http://jppipa.unram.ac.id/index.php/jppipa/index

The Effectiveness of the Reading to Learn (R2L) Model on Scientific Literacy Skills on Static Electricity Topic

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Received: February 9, 2023
Revised: July 30, 2023
Accepted: August 25, 2023
Published: August 31, 2023

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DOI: 10.29303/jppipa.v9i8.3140

Abstract: The purpose of this study was to determine the difference in science learning outcomes between groups of students who participated in learning with the Reading to Learn (R2L) model and direct learning, by analyzing the literacy skills of class IX students at Junior High School in Bukittinggi, West Sumatra. The study population was all students of class IX and the sample class was selected by purposive sampling technique, so that class IX-6 was obtained as the experimental group and class IX-4 as the control group, with a sample of 56 students. This research is a quasi-experimental research with a pretest and posttest group design pattern. The data collected is a test of learning outcomes which are analyzed quantitatively to measure students' scientific literacy skills which are grouped into 3 aspects, namely numerical, conceptual, and multidimensional aspects. The instrument used is a scientific literacy test in the form of 10 description questions. The results show that the research hypothesis H1 is accepted because the table shows that t count > t table. This hypothesis test found that the application of the Reading to Learn (R2L) approach had an effect on students' scientific literacy skills. While the results of the experimental group N-Gain was 0.44 or 44% in the medium category (less effective). So we look at some of the factors causing it by giving questionnaires to students. Based on statistical calculations, the scores for each indicator in the questionnaire are 87.5% of students using local languages in daily conversation, reading time of 10-30 minutes is 46.88%, and courses or tutoring outside school hours are 28.13%.

Keywords: N-gain; Reading to learn (R2L); Sains literacy

Introduction

Global changes are felt so rapidly entering the 21st century. These changes have an impact on all development sectors, including the education sector. In the 21st century, Indonesia is getting ready for a promising era by cultivating students who are in line with contemporary requirements. This goal is attained through education and appropriate instructional approaches and strategies, all under the guidance of teachers' roles in the learning journey (Fitriani et al., 2022). Education is a benchmark in determining the progress of a nation. Education today encourages the younger generation to develop their potential by continuing to innovate and work so that they can survive in the face of global competition. Education prepares quality students who have an awareness of knowledge, values, skills and attitudes (Thahir et al., 2021). One of the things that must be implemented is to develop potential through the field of education. Science is needed in everyday life to meet human needs by solving identifiable problems. All these problems can be solved if people have scientific literacy. Efforts to increase scientific literacy in the field of education began to be carried out at the secondary school level by the government by implementing the 2013 curriculum.

Science has a very important role in the development of science and technology and is one of the components that affect human resources. Therefore, the scientific ability of the community must continue to be developed so that it becomes better. Since Indonesia's participation in the PISA and TIMSS surveys, Indonesia's scientific literacy has not increased significantly (Suparya et al., 2022). It is the result of a

How to Cite:
Arif, K., Rusma, O.R., Putri, A.M., & Azzahra, F. (2023). The Effectiveness of the Reading to Learn (R2L) Model on Scientific Literacy Skills on Static Electricity Topic. *Jurnal Penelitian Pendidikan IPA*, *9*(8), 6425–6431. https://doi.org/10.29303/jppipa.v9i8.3140

study organized by the Organization for Economic Co-operation and Development (OECD) as part of the PISA (Program for International Student Assessment) program on the evaluation of scientific learning outcomes at the international level. It is still far from Indonesia to other countries. Student Assessment (PISA) still needs to be improved. Reporting from the daily Kompas.com, in 2018 based on the PISA results achieved by Indonesia Literacy ranks 72 out of 77 countries, maths rank 72 out of 78 countries, and achievement in science ranks 70 out of 78 countries (OECD, 2019). Based on the results of these achievements, this can be a reason to raise Indonesian students' educational attainment and proficiency, particularly in literacy.

Scientific literacy is the skill of a person to use scientific concepts to apply them in life, to explain scientific phenomena and to describe them based on scientific evidence (Turiman et al., 2012). Scientific literacy is crucial in solving problems related to knowledge (Puskurbuk, 2017). Previous research revealed that reading activities can develop students' scientific literacy skills. A study suggests that reading activity is one of the effective ways that can maintain the student's epistemic insight, which is at the heart of scientific literacy (Kiang et al., 2020). Scientific literacy is the skill of a person using scientific concepts to apply them in life, explaining scientific phenomena and describing these phenomena based on scientific evidence.

Literacy skills are not only reading and writing, but linking thinking skills so that they become a literate generation in science learning. Reading skills are not just reading and writing, but connecting thinking skills so that they become the smart generation in learning science. Reading skills are a means of helping scientific steps to obtain scientific truth. By thinking scientifically, students can acquire the ability to investigate scientifically well, systematically and carefully (Martínez et al., 2015). Reading skills are a strong reason for improving students' literacy skills, this also leads to skills in mastering data, analyzing, critical vulnerability, and being reflective (Septiani et al., 2019). Students' scientific literacy skills can be improved in the right way and supported by sufficient technology (Fitriyana et al., 2020). Learning also ignores direct experience for fear of not being able to finish the subject matter (Ali, 2018).

This causes students to tend to be passive and less likely to contribute to building and acquiring knowledge. Other factors that cause students' low scientific literacy skills include the choice of learning knowledge of centers and centers, gaining knowledge of resources, coaching materials, and so on. Giving material by teachers to students to develop reading and writing literacy skills does not involve innovative and creative approaches in the learning process. In addition, the way teachers deliver material tends to use teacher-centered lecture methods, so students are not the main focus of learning. As a result, a significant increase in student literacy was not achieved (Nurcholis et al., 2021). The ability of students' scientific literacy is influenced by all components of the education system. This includes an inadequate curriculum for directing the development of scientific literacy as well as a lack of effort on the part of teachers to develop students' scientific literacy abilities, especially in the context of learning activities (Zulaiha et al., 2021).

The comprehension of students regarding the taught material is hindered due to the inadequacy of the chosen models and media. Consequently, students primarily receive information delivered by the teacher, with minimal active engagement in the learning process (Nasriyanti et al., 2021). The learning model plays an important role as a successful supporting medium for training students' skills in learning activities. An appropriate model is needed and in accordance with the objectives to train students' literacy and literacy competencies. The reading to learn (R2L) model is one that can help students become more proficient readers and writers. Reading for Learning (R2L) is a set of strategies designed to increase students' literacy competence through reading and writing activities (Rose, 2021).

To improve scientific literacy by using an R2L model that focuses on reading activities, students must be familiar with reading activities (Muttaqiin et al., 2016). Therefore, it is hoped that this model can assist students in increasing student learning literacy in terms of reading, mathematics or science. In the Reading to Learn (R2L) learning process, students are accustomed to reading and writing, which is one aspect of solving scientific literacy problems, especially on static electricity. With the problems that have been described, it means that there is a need for learning methods that can have a positive influence on scientific literacy. So a study was conducted with the aim of looking at the effect of the Reading to Learn (R2L) model on the scientific literacy skills of Junior High School students.

Method

One Group Pretest-Posttest Design is the design for this kind of experiment research, which can be described as follows:

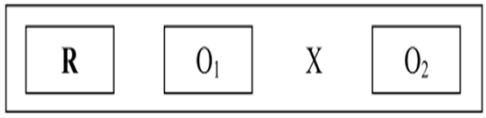

Figure 1. Experiment design schematic

The sample in this study was taken as many as two classes, namely class IX-6 and IX-4, each class amounted to 28 student. The technique used in this sampling is purposive sampling technique, namely taking samples based on certain considerations (Sugiyono, 2019). The considerations made in taking this sample are based on academic scores between the two classes which are almost the same and adjustments to the schedule of subjects in each class. The instrument of research used was 10 question essay-based scientific literacy. The description test is made based on students' scientific literacy indicators which include numerical, conceptual, and multidimensional aspects. Data were obtained through a description test given before (pretest) and after being applied (posttest) in the experimental group and normal learning in the control group. Researchers can determine students' scientific literacy skills based on pretest and posttest scores and describe the effect of the Reading to Learn (R2L) learning model on the experimental group for six meetings. At the first meeting a pretest was conducted and at the sixth a posttest was conducted.

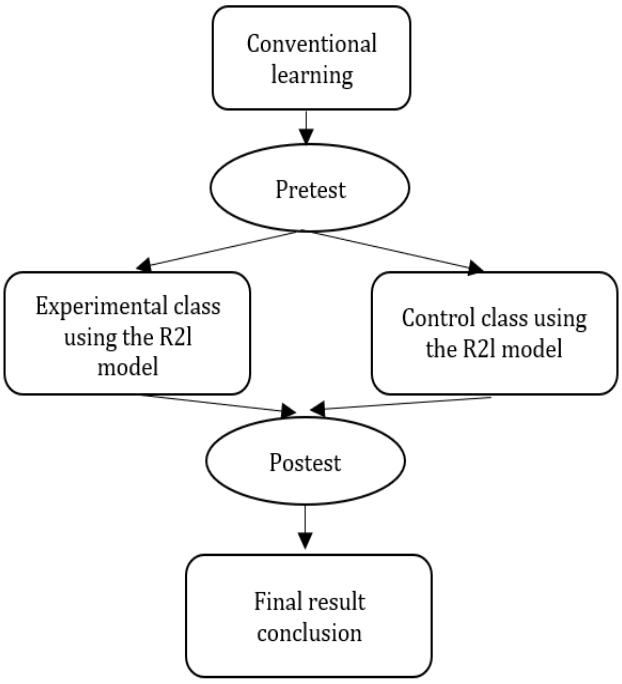

Figure 2. Research design

This study's method for data analysis is to calculate the percentage of respondents' answers, namely the number of correct answer scores for each aspect of the observation divided by the best score for each observational aspect multiplied by 100% (Wahab et al., 2021) science learning outcomes criteria can be seen in Table 1.

Furthermore, the normalized gain test (N-Gain) was conducted to determine the effect of the Reading to Learn (R2L) learning model on students' cognitive learning outcomes. N-gain is used to show the effectiveness of a given intervention and to indicate an increase in learning outcomes between posttest and pretest scores (Trisnani et al., 2021). The calculation of the normalized gain score (N-Gain) can be expressed in the following formula (Hake, 1999).

Table 1. Category of Learning Outcomes (Supangat, 2007)

Range	Criteria Score
75.01-100	Very Good
50.01-75	Good
25.01-50	Enough
00.00-25	Not Enough

$$N - Gain = \frac{Sf - Si}{100 - Si} \quad (1)$$

Description:
Sf = Posttest Score
Si = Pretest Score

Table 2. N-Gain Level Criteria

Limit	Criteria
0.71 – 1.00	High
0.31 – 0.70	Medium
0 – 0.3	Low

Table 3. N-Gain Percentage Interpretation

Percentage (%)	Interpretation
0 < g < 40	Ineffective
40 < g < 55	Less effective
< g < 75	Effective enough
>76	Effective

Result and Discussion

Based on the research that has been done, the data were obtained from the results of the pretest and posttest of two group. Aspects that need to be known include: numerical, contextual, and multidimensional aspects. The second test was given to find out the description of science learning outcomes using the reading to learning (R2L) learning model and conventional learning and to determine the effectiveness of student learning outcomes using N-Gain.

Pretest Results of the Experimental and Control Groups Before Being Given Treatment

Before being given different treatment between the experimental group and the control group, a pretest was carried out and the calculation results were obtained from both groups. The results can be seen in the Table 4.

Table 4. Pretest Results for Class IX.6 and IX.4 Before Being Given Treatment

Group/ Category	Mean	Median	Mode	Highest Score	Lowest Score
Experimental	51.06	49.00	56.00	72.00	29.00
Category	Good	Enough	Good	Good	Enough
Control	54.13	56.00	58.00	77.00	35.00
Category	Good	Good	Good	Very Good	Enough

From the table, we can see that the mean score of the control class is higher than the experimental group. Furthermore, to find out the percentage of each indicator of scientific literacy ability in 3 are numerical, conceptual, and multidimensional aspects can be seen in the Table 5.

Table 5. Student Scores Based on 3 Assessed Aspect

Aspect	Mean
Numerical	35.34
Conceptual	54.37
Multidimensional	63.47

Posttest Results of the Experiment and Control Groups After Being Given Treatment

After the learning activities were carried out to the experimental and control groups, then the posttest was carried out, the scores were obtained as shown in Table 6.

Table 6. Posttest Results for Class IX.6 and IX.4 After Being Given Treatment

Group/ Category	Mean	Median	Mode	Highest Score	Lowest Score
Experimental	72.68	73.00	73.00	85.00	45.00
Category	Good	Good	Good	Very Good	Enough
Control	71.65	74.00	73.00	79.00	41.00
Category	Good	Good	Good	Very Good	Enough

After being given treatment to the experimental and control groups, the posttest score increased from the pretest and the experimental group scores were higher than the control group. To find out the percentage of each indicator of scientific literacy ability in 3 aspects of posttest science competence, it can be seen in Table 7.

Table 7. Student Scores Based On 3 Assessed Aspects Conclusion

Aspect	Mean
Numerical	69.48
Conceptual	75.39
Multidimensional	72.87

The value data above can be seen that the literacy ability of students in terms of 3 aspects are numerical, conceptual, and multidimensional has increased where the experimental group has a higher value than the control group.

Prerequisite Test and Hypothesis Test

Prerequisite test needs to be done to find out whether the data is normally distributed and homogeneous. The normality test is a statistical analysis that will be used for the next. To determine normality, two data sets were tested. The results of this normality test can be seen in Table 8.

Table 8. Normality Test Results

Liliefors Test	Treatment	Sig.	α
Experimental	Before	0.099	
Group	After	0.125	0.05
Control Group	Before	0.163	
	After	0.093	

The normality test results using the Shapiro-Wilk test are shown in Table 8. When the Sig. > 0.05 (Sigih, 2014) then the hypothesis is normally distributed (H0) and vice versa. For the experimental and control groups, after carrying out the testing the results of the data are normally distributed.

The homogeneity test results in this study were calculated using Levene's test. Levene's test utilizes a one-way analysis of variance approach. Data transformation involves computing the disparity between individual scores and the mean of their respective groups (Sianturi, 2022). The data from the homogeneity test can be seen in Table 9.

Table 9. The Results of Homogeneity Test

Homogeneity Test	Pretest F-Test	Posttest F-Test
Sig.	1.34	1.41
α	0.05	0.05
Decision	Homogeneous	Homogeneous

The variance between the two groups was homogeneous, as shown by Table 9 using Levene's statistic. If the data is normally distributed and homogeneous, then the t test is used for hypothesis testing (Sundayana, 2016). Table 10 contains the results of the t-test calculations.

Table 10. Hypothesis Test Results

t test	t count	t table	Information
t test the value of the posttest	2.15	2.00	t count > t table

The t count and t table values are 2.15 and 2.00, respectively, according to the calculation table for the

hypothesis test. The research hypothesis H0 is rejected and H1 is accepted because the table shows that t count > t table. This hypothesis test found that the application of the Reading to Learn (R2L) approach had an effect on students' scientific literacy skills.

N-Gain Score and Questionnaire

Table 11 below shows the results of the N-gain calculation to see the effect of applying the Reading to Learn (R2L) model on students' reading and writing skills, the N-Gain test is carried out as Table 11.

Table 11. The Results of the Average N-Gain for Experiment and Control Group

Average	Experimental Group	Control Group
Pretest	51.06	54.13
Posttest	72.68	71.65
N-Gain	0.44	0.38
Category	Medium (Less effective)	Medium (Ineffective)

Based on Table 11, the overall average N-Gain score is 0.44 or 44% with the category of the effect of applying the Reading to Learn (R2L) model on students' cognitive learning outcomes is classified as medium (Less effective). From these results, to find out other influencing factors, a questionnaire was given to students containing 3 main indicators, namely the language used in daily conversation, the duration of reading time outside of class hours, and courses or tutoring followed outside of school. The data obtained can be depicted in the following chart/diagram.

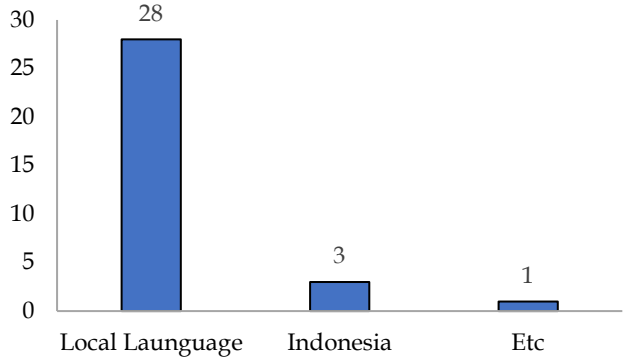

Figure 3. Daily conversational language

Based on the graphs in Figures 3, it can be seen that most students use the local everyday language more than Indonesian or other languages. The impact of regional languages on the learning results of the Indonesian language is substantial. Within the realm of educational progress, culture constitutes one of the contributing elements. Hence, it becomes imperative for educators to respond with suitable measures (Nani et al., 2019). Indonesian has an important role in achieving success in understanding all fields of study. The language learning process is expected to be able to help students recognize their own identity, culture, and the cultures of other individuals (Lestari et al., 2022).

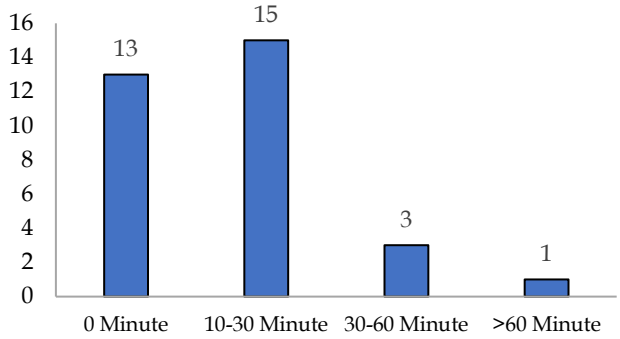

Figure 4. Length of reading time outside of school hours

Furthermore, students' interest in reading can be seen in Figure 3, where the youngest students begin to read after 10-30 minutes, while the oldest students do not read at all when at home, and only a small number of students read for more than 30 minutes. In the realm of education, the ability to read is a skill that must be mastered by students because it is the main basis for gaining knowledge from all subject areas taught at school (Deviana et al., 2017). Therefore, literacy activities have a very important role in increasing students' interest in reading and have the potential to increase their learning achievement (Sari, 2020).

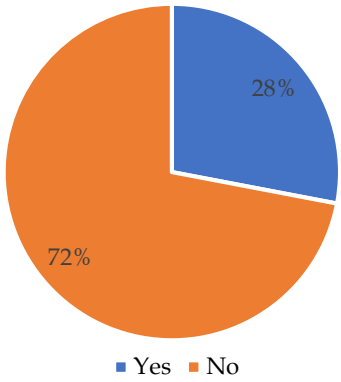

Figure 5. Take study courses

From these data, we can know that there are other factors that greatly affect students' scientific literacy skills, so this information will be important for future improvements. The fact that students' reading skills are still not encouraging indicates that further learning outcomes have not been fully achieved (Mualimah et al., 2018).

Conclusion

The application of the Reading to Learn (R2L) model has an effect on students' cognitive learning outcomes at the junior high school level although it is less effective (medium category. This can be caused by several factors supporting students' literacy skills. Some of the main factors outside of learning that are very important include the language in daily conversation with the regional language, making it difficult for students to understand Indonesian texts, the average reading frequency of students is low, and the number of students taking tutoring outside of school. It is recommended that the Reading to Learn (R2L) model be applied by taking into account external factors that are very influential.

Acknowledgments
We would like to express our gratitude to everyone who contributed to this study in the City of Bukittinggi, West Sumatra. Hopefully useful for the advancement of science.

Author Contributions
YUN, who was the supervisor of this research, has reviewed and monitored the progress of the research. KA, ORR, FA, AMP find problems in schools and develop research instruments, analyze data, and produce manuscripts. KA and FA reviewed and finalized the manuscript. RO and RYS provide alternative methods for analyzing data. All authors have read and agree to the published version of the manuscript.

Funding
This research received no external funding.

Conflicts of Interest
The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

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