PROCEEDING
International Conference in Education and Vocation
Multicultural and Inclusive Approaches
ICEV-MIA 2026

IMPLEMENTATION OF THE INQUIRY LEARNING MODEL USED BY LMS WORDWALL TO IMPROVE STUDENTS' SCIENCE LITERACY ON BACTERIA MATERIAL

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ABSTRACT

Scientific literacy is an important skill that students must have to understand scientific concepts, interpret data, and apply knowledge in everyday life, especially in biology learning on bacteria material that requires critical thinking and scientific reasoning skills. This study aims to determine the effect of implementing an inquiry learning model supported by the Wordwall Learning Management System (LMS) on improving students' scientific literacy at SMA Negeri 2 Pekanbaru. The research used a quantitative approach with a quasi-experimental design in the form of a non-equivalent pretest-posttest control group. The population consisted of students of grades X7 and X9 in the 2025/2026 academic year, with two classes selected through purposive sampling as the experimental and control classes, each consisting of 44 students. The research instruments included inquiry-based learning modules and LKPD integrated with the Wordwall LMS, while data collection used scientific literacy tests and observation sheets of teacher and student activities during the learning process. The results showed that the average N-gain of scientific literacy in the control class was 0.30, categorized as low, while the experimental class obtained 0.38, categorized as medium. The independent t-test result showed a significance value (2-tailed) of 0.00 < 0.05, indicating a significant difference between the two groups. Thus, the implementation of the inquiry learning model assisted by the Wordwall LMS significantly improved students' scientific literacy on bacteria material.

Keywords: Inquiry Learning; Wordwall; Science Literacy; Bacteria

1. INTRODUCTION

21st-century education demands that students possess critical, creative, collaborative, and communicative thinking skills, reflected in scientific literacy, namely the ability to understand concepts, evaluate data, and make evidence-based decisions (Fitriani & Fathurrohman, 2021; Prastiwi et al., 2020). Science instruction in schools is still dominated by lecture methods, thus under-training higher-order thinking skills (Harefa, 2020; Safira et al., 2023). This has resulted in Indonesia's low scientific literacy achievement, which, according to the 2022 PISA results, scored 383, below the international average (OECD, 2023). This situation highlights the need for learning innovations that can systematically train scientific inquiry skills, particularly in biological materials such as bacteria, which are contextual and closely related to everyday life (Herayana et al., 2020).

A relevant model is inquiry learning, which positions students as active subjects in the process of observation, problem formulation, and conclusion drawing (Sutiani et al., 2021; Pujani, 2022). This model has been shown to improve conceptual understanding and critical thinking (Prasetiyo & Rosy, 2020), especially when combined with interactive digital media such as Wordwall, which can increase motivation and learning participation (Arsini et al., 2022; Sinaga & Soesanto, 2022; Ma'wa, 2024). Although several studies have demonstrated the effectiveness of

integrating inquiry and Wordwall (Widyaningrum et al., 2024; Amelia et al., 2024), studies at the high school level, specifically on bacteria, with a focus on measuring scientific literacy, are still limited. This study aims to analyze the effect of implementing inquiry learning assisted by the Wordwall LMS on improving high school students' scientific literacy in bacteria.

2. METHODOLOGY

Quantitative research methods play a crucial role in scientific research, particularly in generating objective and measurable data. This method is widely used to answer research questions that require numerical and statistical analysis (Waruwu et al., 2025). This study employed a non-equivalent pretest-posttest control group design to manage data between the control and experimental groups, with pretests and posttests.

The population in this study was all 10th-grade students, while the sample was determined using a purposive sampling technique, considering the equivalence of students' initial academic abilities. The sample consisted of two classes, each with approximately 44 students. The determination of the experimental and control classes was based on discussions with the school administration to ensure equivalence in the characteristics of both groups.

The research instruments used included a science literacy test, a learning implementation observation sheet, and a student response questionnaire. The science literacy test was structured as a multiple-choice test that refers to the indicators of science literacy, namely the ability to explain scientific phenomena, design and evaluate scientific investigations, and interpret scientific data and evidence. Before use, the test instrument underwent a content validity test by expert judgment and an empirical validity test using Product Moment correlation. Reliability testing was conducted using the Cronbach's Alpha coefficient to ensure the instrument's internal consistency. The observation sheet was used to ensure the implementation of the inquiry learning syntax as planned, while the student response questionnaire aimed to determine students' perceptions and responses to the use of the LMS Wordwall in the learning process.

The research procedure began with a pretest administered to both groups to measure students' initial scientific literacy skills. Next, the experimental class received a treatment in the form of learning using the inquiry learning model assisted by the LMS Wordwall, implemented over several meetings on the topic of bacteria. Learning was carried out according to the stages of inquiry learning: orientation, problem formulation, hypothesis development, data collection through investigative activities, data analysis, and conclusion drawing. Meanwhile, the control class followed the learning process using conventional methods. After the entire learning process was completed, both groups were given a posttest to measure improvements in scientific literacy.

The research data was analyzed quantitatively by first conducting prerequisite tests, namely normality and homogeneity tests. Differences in scientific literacy outcomes between the experimental and control classes were analyzed using an Independent Sample t-test at a significance level of 0.05. Improvements in students' scientific literacy were calculated using the N-Gain formula to determine the effectiveness of the treatment. The entire data analysis process was conducted using statistical software.

The data analysis techniques used in this study were. Quantitative data analysis. To determine improvements in learning outcomes, the N-Gain formula was used (Meltzer, 2002). The formula is as follows:

$$\text{N-Gain} = \frac{S_{post} - S_{pre}}{S_{maks} - S_{pre}}$$

Information :

Spost : Posttest score
Spre : Pretest score
Smax : Ideal maximum score

To test the comparative hypothesis, a two-sample t-test (independent sample t-test) is used for parametric (if the data is normally distributed) or the Mann-Whitney U-test for non-parametric. The t-test is used if the data is normal or homogeneous. To determine normal data, normality and homogeneity tests are used (Sugiyono, 2010).

a. Normality Test

A normality test is needed to determine the distribution of data. One method used to test data normality is the Kolmogorov-Smirnov Method (KS-21). The Kolmogorov-Smirnov test formula is:

$$KS = | Fn_{(Yi-1)} - Fo_{(Yi)} |$$

Description:
KS : Calculated KS value
Fn(Yi – 1) : Cumulative percentage frequency at time before i Fo(Yi): Frequency of normal distribution data at the current time

b. Homogeneity Test

A homogeneity test is conducted to determine the uniformity of research data. In good regression analysis, research data must have a homogeneous distribution, and the method used to test this is the Levene's Test.

The Levene's Test formula is as follows (Sugiyono, 2010):

$$L = \frac{(N-k)\sum ni\,(\bar{V}i - \bar{l})}{(k-1)\sum(\bar{V}ij - \bar{V})}$$
$$V_{ij} = |X_{ij} - \bar{X}$$

Description:
L: Levene's calculated value
X: Residual data value
x: Average residual data
N: Number of samples
K: Number of groups

c. T-test

Sugiyono (2010) states that hypothesis testing can be done using the t-test formula as follows:

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{S_1^2 + S_\tau^2}}$$

Description:
X1 : Average value of the experimental group
X2 : Average value of the control group
S12 : Variance of the experimental group's values
Sτ2 : Variance of the control group's values

To test the research hypothesis, the following statistical hypotheses were formulated:
H0 = There is no effect of the Inquiry Learning model on scientific literacy in the bacterial

material of students at State Senior High School 02 Pekanbaru.

H1 = There is an effect of the Inquiry Learning model on scientific literacy in the bacterial material of students at State Senior High School 02 Pekanbaru.

3. RESULTS

This study aims to determine the effect of implementing an inquiry learning model supported by a Wordwall-based Learning Management System (LMS) on improving students' scientific literacy in bacteria. Data were obtained from pretest and posttest results in the experimental and control classes.

a. Pretest and Posttest Results

The data were obtained by analyzing a learning motivation questionnaire consisting of seven indicators: "Persistence in facing tasks" and the sub-indicators "Persistence in facing problems," "Showing interest in learning," and "Easily getting bored with assigned tasks."

Table 1. Average Pretest and Posttest Scores

No	Kelas	n	Rata-rata Pretest	Rata-rata Posttest
1	Kontrol	44	65,11	75,61
2	Eksperimen	44	70,45	81,74

Based on the descriptive analysis, the average pretest score for the experimental class was 70.45, higher than the 65.11 for the control class. This indicates a difference in initial abilities between the two classes, although the difference was not significant. After the treatment, the average posttest score for the experimental class increased to 81.74, while the average posttest score for the control class increased to 75.61. The increase in the experimental class' score (11.29) was higher than that for the control class (10.50). Descriptively, these results indicate that learning in the experimental class had a positive impact on students' scientific literacy.

b. Results of N-Gain Calculation

Table 2. Average N-Gain for Scientific Literacy

No	Kelas	n	Rerata	Kategori
1	Kontrol	44	0,30	Rendah
2	Eksperimen	44	0,38	Sedang

Based on the N-Gain calculation, the control class obtained an average score of 0.30, which is in the low category, while the experimental class obtained an average score of 0.38, which is in the medium category. These results indicate that the increase in scientific literacy of students in the experimental class was higher than in the control class.

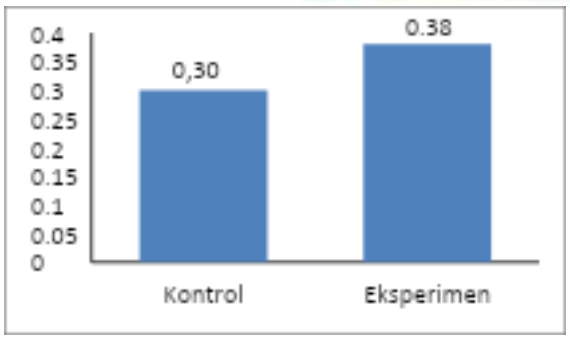


Figure 1. Bar Chart Comparing the Results of the N-Gain Values of the Control Class and the Experimental Class

c. T-Test Results

Table 3. T-Test Results

Kelas	*Asymp. Sig. (2-tailed)*	α	Keputusan	Keterangan
Eksperimen dan Kontrol	0,00	0,05	Tolak H_0	Berbeda signifikan

Based on the results of the hypothesis test using the Independent Sample t-test, the Asymp. Sig. (2-tailed) value was 0.00. This value is lower than the specified significance level (α = 0.05), so H_0 is rejected and H_1 is accepted. This indicates a significant difference between the scientific literacy outcomes of students in the experimental and control classes.

Table 4. Summary of Teacher Activities in the Control and Experimental Classes

	Aktivitas (%)		
Kelas	**Pertemuan I**	**Pertemuan II**	**Rerata Presentase (%)**
Kontrol	83	92	88
Eksperimen	95	100	97

Based on teacher activity in the control class, it reached 83% in the first meeting and increased to 92% in the second meeting, with an average of 88% for both meetings. Meanwhile, teacher activity in the experimental class reached 95% in the first meeting and increased to 100% in the second meeting, with an average of 97% for both meetings. The increase in teacher activity in both the control and experimental classes was also influenced by student activity. The following table summarizes student activity in the control and experimental classes:

Table 5. Summary of Student Activity in the Control Class

Pertemuan	Aktivitas (%)				Rerata Persentase (%)
	1	2	3	4	
I	77,27	72,72	66,00	77,27	73,31
II	81,81	72,27	68,18	84,10	76,59

The table shows that the average percentage of student activity in the control class reached 73.31% in the first meeting and 76.59% in the second meeting. This contrasts with the activity in the experimental class, as seen in the table below:

Table 6. Summary of Student Activity in the Experimental Class

P	Aktivitas (%)							Rerata Persentase (%)
	1	2	3	4	5	6	7	
I	77,27	81,81	84,10	77,00	81,81	68,18	72,72	77,55
II	79,54	88,63	81,81	80,00	86,36	72,72	72,72	80,25

Based on the observations in the following table, the average percentage of students in the first meeting of the experimental class was 77.55%. Furthermore, the second meeting of the experimental class showed a figure of 80.25%. The increase in student activity in the experimental class was also influenced by the teacher's activity in the class.

4. DISCUSSION

This study shows that the application of the inquiry learning model assisted by the Wordwall LMS has a positive and significant effect on improving students' scientific literacy on bacteria material, as indicated by an increase in posttest scores compared to pretests in both classes, with the average posttest and N-Gain of the experimental class (0.38; medium category) higher than the control class (0.30; low category), as well as the results of the statistical test Sig. (2-tailed) = 0.000 < 0.05 which indicates a significant difference between the two. This advantage is supported by the characteristics of inquiry learning that actively involve students in the scientific process—starting from observing, formulating problems, collecting and analyzing data, to drawing evidence-based conclusions—thus training the ability to explain phenomena, interpret data, and relate concepts to everyday life, which is further strengthened through the integration of Wordwall with quiz activities and interactive games that increase motivation, participation, and conceptual understanding. In addition, the observation results showed that teacher and student activities in the experimental class were more optimal, with students being more active in asking questions, discussing, and presenting results, while the teacher acted as a facilitator, so that learning became more interactive and student-centered compared to conventional learning in the control class.

5. CONCLUSION

The implementation of the inquiry learning model, supported by the Wordwall Learning Management System (LMS), had a positive and significant impact on students' scientific literacy in the bacteria topic at SMA Negeri 2 Pekanbaru. The t-test results showed a significance value <0.05, indicating a significant difference in scientific literacy between the inquiry learning model supported by the Wordwall Learning Management System (LMS) and conventional learning.

The improvement in scientific literacy was demonstrated by the N-Gain results in the experimental class, which were in the moderate category, and teacher and student activity, which was in the good to excellent category. Based on these research results, the inquiry learning model supported by the Wordwall Learning Management System (LMS) is effective as an alternative

biology learning method to improve students' scientific literacy, particularly in the bacteria topic.

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