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The Impact of Moodle on Scientific Attitudes Skills and Student's Motivation on Science Learning in Elementary School

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Abstract: The aim of the study was to determine the effect of LMS Moodle on scientific attitudes and motivation in science lessons for class V at SDN Demangan, to find out differences in scientific attitudes and learning motivation between classes using Moodle LMS and classes using PowerPoint in science lessons for class V at SDN Demangan. The subjects in this study were 44 students in class 5 of SDN Demangan. The research method uses a quasi-experimental design with a non-equivalent control group design. The data analysis technique used is the paired samples t-test and the independent samples t-test. The results showed that there was a significant and positive effect of the use of LMS Moodle and Powerpoint on scientific attitudes and learning motivation of students with the results of the t test analysis respectively of 11.762, 10.283 and 8.047 and 10.109 with the same significance 0.00 < 0.05, there are differences in scientific attitudes and learning motivation between classes using Moodle LMS media and classes using PowerPoint media with a significance level (2-tailed) 0.009 < 0.05.

Keywords: Learning management system moodle; PowerPoint; Scientific attitudes; Student's motivation

Introduction

Natural Sciences (IPA) play a vital role in the learning process at the elementary school level. The study of Natural Sciences in elementary schools provides students with foundational knowledge of basic scientific concepts and natural phenomena, serving as an initial stepping stone for further study of science in higher educational levels (Rahmawati & Melisa, 2016). The development of scientific attitudes forms an inseparable foundation for the conceptual development of scientific products. These scientific attitudes underpin the application of the scientific method, which in turn generates scientific products. These attitudes are not only individual but also collective, as communities can bear irreducible psychological-epistemic states that contribute to scientific advancement (Harris, 2021). At the elementary school level, Natural Sciences learning serves as an essential foundation for shaping students' knowledge, skills, and scientific attitudes (Tursinawati, 2015). Natural Sciences learning at the elementary level is crucial for developing students' scientific literacy and critical thinking, equipping them with knowledge, skills, and attitudes necessary for responsible citizenship (Vieira & Tenreiro-Vieira, 2016).

Scientific attitudes shape learning activities that go beyond focusing solely on cognitive aspects (Maimunah, 2016), providing students with opportunities to naturally enhance their curiosity. Curiosity is linked to increased learning and is essential for developing scientific attitudes (Peterson, 2020). This aims to enable students to develop the capability to seek answers based on data, thereby fostering the growth of scientific attitudes (Julimah et al., 2020). Consequently, students require well-developed scientific attitudes, as these have a significant impact on science learning outcomes (Erita,

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2017) and positively influence students' learning motivation (Samatowa, 2010; Mawati et al., 2021).

Learning motivation plays a crucial role in fostering enthusiasm and energy in learning activities (Sitompul et al., 2018). Each individual has a different level of motivation from each other. Motivation has the ability to increase the goals and targets to be achieved in learning outcome (Nur & Ikhsan, 2024). When students possess strong motivation, they are more likely to actively participate in the learning process. Conversely, weak motivation can lead to a lack of willingness to engage in learning activities, which in turn may result in various issues affecting learning outcomes (Chotimah & Fathurrohman, 2018; Hakim et al., 2020). Skinner et al. (2008) suggested that emotional forms of engagement (interest, enthusiasm) were likely to play a key role in the emergence of other (cognitive and behavioral) forms of engagement. This proposition thus positions emotional forms of engagement as mediators of the effects of various predictors (including motivation) on other facets of student engagement. In line with observations in the field, students exhibit diverse characteristics; some demonstrate the ability to engage effectively in the learning process, while others face difficulties in participating in learning activities, including in science (IPA) subjects. As a result, some students report challenges in learning science, which ultimately leads to low academic performance in the subject. The low science learning outcomes can be attributed, among other factors, to a lack of scientific attitudes (Mediartika & Aznam, 2018) and insufficient learning motivation (Dani et al., 2019).

Based on preliminary interviews conducted with the fifth-grade teacher at SDN Demangan in March 2024, it was found that students have not yet optimized their practice and development of scientific attitudes and are less motivated to learn. The results of the interviews and observations revealed that the teacher often employs expository teaching methods combined with assignments, question-and-answer sessions, and occasional discussions during science (IPA) lessons. This approach affects students' engagement in learning activities. During science learning activities, students were observed to merely receive material delivered verbally by the teacher, which led to a tendency for students to remain passive and reliant on the content presented by the teacher.

In learning activities, several limitations are experienced by both teachers and students. These limitations include students often lose focus when the learning session extends for a considerable time. The factors such as teacher support and student interests are crucial in maintaining motivation and engagement (Redondo & Martín, 2015); while the infrastructure is adequate, evidenced by the availability of free Wi-Fi and the allowance for students to bring mobile phone to class, e-learning media as additional support has not yet been provided. Teachers primarily rely on books, WhatsApp groups, and PowerPoint as teaching media; teachers lack variety in implementing innovative models, methods, and strategies during instruction. Expository learning is frequently applied, with limited use of active learning models such as Problem-Based Learning (PBL); students do not strive to gain knowledge through solving problems but merely aim to complete and submit the tasks. When answering questions, students often copy-paste from books or videos provided by the teacher, without engaging in deeper meaning-making. This highlights a lack of curiosity, critical thinking, scientific attitudes, and learning motivation among students.

Based on the identified issues and the potential of the school, it is necessary to implement a more meaningful learning process that accommodates students' scientific attitudes and learning motivation. In the learning process, teachers should cultivate an interactive learning environment that promotes not only teacher-student interaction but also student engagement with their surroundings. Besides, science teaching often encounters challenges such as limited engaging learning media and low student interest in science subjects (Smaldino et al., 2011; Hartomo & Sukmawati, 2024; Regina & Wulandari, 2025). Furthermore, collaboration between teachers and students is essential to foster a spirit of cooperation and mutual support (Dwiyanti & Setyasto, 2025). External and internal factors are involvedin creating learning outcomes of maximum cognitive abilities. One of the external factors that influence the cognitive abilities of the student is the learning model (Kurniawati et al., 2023). There are various types of learning that can be practiced, including problem-based learning. Problem-based learning is a model in which teachers provide real and relevant problems to learners to be solved. Students conduct group discussions, so that there is an exchange of information to be able to solve the problem with the teacher as a facilitator (Wulandari & Surjono, 2013). This aligns with the learning approach envisioned by the Merdeka Curriculum. According to the Ministerial Regulation of Education, Culture, Research, and Technology (Permendikbudristek) Number 12 of 2024 on the Curriculum for Early Childhood Education (PAUD), Basic Education, and Secondary Education and Law Number 20 of 2003, the prioritized learning models include problem-based learning, project-based learning, inquiry-based learning, and discovery learning, differentiated learning, and social-emotional learning.

Besides the use of learning models, media also plays a crucial role in the success of the learning process. Given the potential of SDN Demangan, which is

equipped with Wi-Fi and has started utilizing digital technology to support learning, one of the resources available is gadgets, which are owned by most students and permitted for use in school. In addition to teacher-led instruction during both in person and online learning sessions, students' understanding can be further enhanced by utilizing digital technologies and internet-based media. These tools support the learning process and expand access to educational resources beyond the classroom setting (Dari et al., 2022). Therefore, the implementation of the PBL model can be integrated into an e-learning platform, such as the Moodle Learning Management System (LMS).

Moodle LMS represents a breakthrough in e-learning for both educators and learners. According to Ibrahim & Suardiman (2014), Moodle is an LMS designed to facilitate collaboration, based on online learning and discovery approaches. As a web-based platform, Moodle utilizes a Learning Management System (LMS) and can be downloaded and installed for free. This learning media is well-suited to the current needs of students, as it is rare to find students who have never accessed the internet. Therefore, the use of web-based media is not unfamiliar to them. The instructional materials provided are ideal for uploading through the web, as this format allows content to be presented in various formats such as text, images, animations, and other multimedia.

Based on the aforementioned explanation, it can be concluded that the science learning process at SDN Demangan, particularly in Grade V, remains suboptimal. The lack of appropriate selection of instructional models aligned with the utilization of available learning facilities provided by the school may contribute to these shortcomings. Therefore, efforts are required to design learning activities aimed at enhancing scientific attitudes and learning motivation through the selection of instructional models and media integrated with the facilities available in the SDN Demangan school environment. With a well-designed instructional approach, it is also possible to foster the development of scientific attitudes and optimize learning motivation.

In line with the aforementioned foundational analysis, the Problem-Based Learning (PBL) model has been shown to foster scientific attitudes and enhance learning motivation in science education among students. By integrating the existing facilities provided by the school, the researcher aims to examine the impact of using the Moodle Learning Management System (LMS) in science subjects for Grade V students at SDN Demangan. The rationale behind conducting this study is that previous research has not specifically investigated the effect of using Moodle LMS on scientific attitudes and learning motivation in science education. Consequently, the impact of Moodle LMS usage on students' scientific attitudes and learning motivation, particularly in science subjects at SDN Demangan, remains unknown. This issue serves as the primary reason for the researcher to address this topic in a thesis entitled The Effect of Using Moodle LMS on Scientific Attitudes and Learning Motivation in Elementary School Science Subjects.

Method

This research was conducted from May 17 to May 31, 2024 at SDN Demangan Yogyakarta involving all classes totaling two classes with a population of 44 students, each class consisting of 22 students. The method used in this study was a quasi-experimental design with a non-equivalent control group design. The initial conditions of students in both classes were assessed by a pre-test, while the post-test was conducted to measure students' scientific attitudes and learning motivation after receiving treatment.

The sampling technique used in this study was census sampling, which is a sampling technique involving all members of the population (Sugiyono, 2012). Census sampling encompasses the entire population, ensuring that every individual is included, which can enhance the reliability of the findings (Souza-Júnior et al., 2015). The researcher used this sampling technique because the number of samples used was relatively small, namely 44 students. The research sample consisted of Class 5A consisting of 22 students as an experimental group using LMS Moodle based on Problem-Based Learning and Class 5B consisting of 22 students as a control group using PowerPoint-based expository learning.

The research stages consisted of data collection, validity testing, reliability testing, data analysis, and hypothesis conclusion. To collect research data, questionnaires on scientific attitudes and learning motivation were used. In general, the steps involved in the data collection process included: developing research instruments, designing learning activities using Moodle LMS and PowerPoint, consulting subject-matter experts for instrument validation, conducting instrument trials, administering pre-tests to both control and experimental groups, implementing the learning intervention, and administering post-tests to both groups. Following data collection, validity and reliability tests were conducted to determine whether the data followed a normal distribution.

Data analysis was conducted using normality tests, homogeneity tests, and hypothesis testing. The hypotheses tested were as follows: Ho: The use of Moodle LMS and PowerPoint does not affect students' scientific attitudes and learning

motivation; Ha: The use of Moodle LMS and PowerPoint affects students' scientific attitudes and learning motivation. Before hypothesis testing, data were first tested for homogeneity and normality. After passing the normality and reliability tests, hypothesis testing was performed using a paired sample test to determine the effect of using Moodle LMS on students' scientific attitudes and learning motivation. Additionally, an independent samples test was used to identify differences in scientific attitudes and learning motivation between students taught using Moodle LMS and those taught using PowerPoint.

The criteria for hypothesis testing are as follows: Ho is accepted if the significance value is > 0.05, indicating that there is no significant effect of using Moodle LMS and PowerPoint on students' scientific attitudes and learning motivation. Conversely, Ha is accepted if the significance value is < 0.05, indicating a significant effect of using Moodle LMS and PowerPoint on students' scientific attitudes and learning motivation. Data analysis in this study was performed using SPSS 25 for windows.

Result and Discussion

This study aims to determine the effect of Moodle LMS on scientific attitudes and motivation in science subjects for Grade V students at SDN Demangan, as well as to identify differences in scientific attitudes and learning motivation between classes using Moodle LMS and those using PowerPoint in science subjects for Grade V students at SDN Demangan.

The data obtained in this study were derived from the pre-test and post-test scores measuring students' scientific attitude skills and learning motivation in both the experimental and control classes. The pre-test was conducted to assess the initial state of students' scientific attitude skills and learning motivation before the treatment, while the post-test aimed to measure these variables after the treatment was administered. The instruments used to measure students' scientific attitude skills and learning motivation, both before the pre-test and after the post-test, were identical for the control and experimental classes.

Table 1 presents descriptive data on the pre-test and post-test scores of students' scientific attitudes in both the experimental and control classes. The highest pre-test score for scientific attitude in the experimental class was 72, while in the control class, it was 73. The lowest pre- test score in the experimental class was 52, and in the control class, it was 53. Table 1 also shows that the average pre-test score for scientific attitude in the experimental class was 60.55, while in the control class, it was 53.41. The highest and lowest post-test scores for scientific attitude in the experimental class were 98 and 65, respectively, with an average score of 77. In the control class, the highest and lowest post-test scores were 80 and 60, respectively, with an average score of 70.73. The higher average post-test score in the experimental class compared to the control class indicates an improvement in students' scientific attitudes.

Table 1. Descriptive data of students' scientific attitudes

	N	Min	Max	Mean	Std Deviation
Pretest experiment (LMS Moodle)	22	52	72	60.55	6.061
Posttest experiment (LMS Moodle)	22	65	98	77.00	8.950
Pretest control (PowerPoint)	22	53	73	63.41	6.419
Posttest control (PowerPoint)	22	60	80	70.73	5.914
Valid n	22				

Table 2 presents descriptive data on the pre-test and post-test scores of students' learning motivation in both the experimental and control classes. The highest pre-test score for learning motivation in the experimental class was 79, while in the control class, it was 80. The lowest pre-test score in the experimental class was 45, and in the control class, it was 62. Table 2 also shows that the average pre-test score for learning motivation in the experimental class was 66.50, while in the control class, it was 73.09. The highest and lowest post-test scores for learning motivation in the experimental class were 100 and 64, respectively, with an average score of 82.00. In the control class, the highest and lowest post-test scores were 88 and 71, respectively, with an average score of 79.45. The higher average post-test score in the experimental class compared to the control class indicates an improvement in students' learning motivation.

Table 2. Descriptive data of students' learning

	N	Min	Max	Mean	Std Deviation
Pretest experiment (LMS Moodle)	22	45	79	60.50	8.342
Posttest experiment (LMS Moodle)	22	64	100	82.00	7.715
Pretest control (PowerPoint)	22	62	80	73.09	4.128
Posttest control (PowerPoint)	22	71	88	79.45	4.361
Valid n	22				

Table 3 presents the results of the normality test for the pre-test and post-test scores of students' scientific attitudes. The normality test results indicate that the pre-test and post-test data in both the experimental and control classes are normally distributed, as all

significance values are greater than 0.05. Similarly, Table 4 displays the normality test results for the pre-test and post-test scores of students' learning motivation. The normality test results reveal that the pre-test and post-test data in both the experimental and control classes are normally distributed, as all significance values exceed 0.05.

Table 5 shows the homogeneity test results for students' scientific attitudes. The homogeneity test results indicate a significance value based on mean of 0.109 > 0.05, leading to the conclusion that the data variances in both the experimental and control classes are equal or homogeneous. Likewise, Table 6 presents the homogeneity test results for students' learning motivation, showing a significance value based on mean of 0.354 > 0.05, which confirms that the data variances in both the experimental and control classes are equal or homogeneous.

Table 3. Normality test of scientific attitude data

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pretest of control	.126	22	.200	.935	22	.158
Posttest of control	.174	22	.081	.939	22	.192
Pretest of experiment	.132	22	.200	.943	22	.230
Posttest of experiment	.158	22	.163	.941	22	.210

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction.

Table 4. Normality test of learning motivation data

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pretest of control class (PowerPoint)	.173	22	.085	.939	22	.191
Posttest of control class (PowerPoint)	.098	22	.200*	.976	22	.853
Pretest of Experiment class (LMS Moodle)	.163	22	.132	.928	22	.111
Posttest of Experiment class (LMS Moodle)	.166	22	.116	.942	22	.213

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction.

Table 5. Homogeneity test of scientific attitude data

	Levene Statistic	df1	df2	Sig.
Based on Mean	2.675	1	42	.109
Based on Median	2.670	1	42	.110
Based on Median and with adjusted df	2.670	1	31.384	.112
Based on trimmed mean	2.825	1	42	.100

Table 6. Homogeneity test of learning motivation data

	Levene Statistic	df1	df2	Sig.
Based on Mean	.879	1	42	.354
Based on Median	.938	1	42	.338
Based on Median and with adjusted df	.938	1	39.752	.339
Based on trimmed mean	.875	1	42	.355

Table 7. Positive and significant effect of using the Moodle learning management system (X1) on scientific attitude (Y1) in science subjects for grade V students at SDN Demangan

		Paired Samples Test							
		Paired Differences							
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper	t	df	Sig. (2-tailed)
Pair 1	Posttest Experiment-Pretest Experiment	14.818	5.909	1.260	17.438	12.198	11.762	21	.000

Subsequently, after conducting normality and homogeneity tests, hypothesis testing was performed, as presented in Tables 7 to 10.

Based on the results of the Paired Samples Test for students' scientific attitudes before and after learning using the LMS Moodle, the sig. (2-tailed) value was 0.00 < 0.05. This indicates a significant difference in the average scientific attitude skills of students before using LMS Moodle and after using LMS Moodle. In other words, there is a significant effect between the pre-test (before treatment) and the post-test (after treatment using LMS Moodle) on students' scientific attitudes. A clearer overview of the average scientific attitude scores before and after learning with the LMS Moodle instructional model can be seen in Table 8.

Table 8. Average scores of students' scientific attitude skills before and after learning using LMS Moodle

	Paired Samples Statistics			
	Mean	N	Std. Deviation	Std. Error Mean
Pretest of experiment class	60.55	22	6.061	1.292
Posttest of experiment class	75.36	22	10.182	2.171

Based on the results of the Paired Samples Test for students' learning motivation before and after learning using LMS Moodle, the sig. (2-tailed) value was 0.00 < 0.05. This indicates a significant difference in the average learning motivation of students before using LMS Moodle and after using LMS Moodle. In other words, there is a significant effect between the pre-test (before treatment) and the post-test (after treatment using LMS Moodle) on students' learning motivation.

Table 9. Positive and significant effect of using the Moodle learning management system (X1) on learning motivation (Y2) in science subjects for grade V students at SDN Demangan

Paired Samples Test

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pretest Eksperimen (LMS Moodle) - Posttest Eksperimen ((LMS Moodle)	-18.864	8.604	1.834	-22.678	-15.049	10.283	21	.000

Table 10. Average scores of students' learning motivation before and after learning using LMS Moodle

Paired Samples Statistics

	Mean	N	Std. Deviation	Std. Error Mean
Pretest of Experiment (LMS Moodle)	66.50	22	8.342	1.779
Posttest of Experiment (LMS Moodle)	85.36	22	5.577	1.189

A clearer overview of the average learning motivation scores of students before and after learning using the instructional model with LMS Moodle media can be seen in Table 10.

Based on the paired samples statistics table above, it can be observed that the average learning motivation score of students before and after learning using LMS Moodle differs, increasing from 66.50 to 85.36. Therefore, it can be concluded that the hypothesis is supported, indicating a significant positive effect on the learning motivation of students who learned using LMS Moodle in the science subject for Grade V students at SDN Demangan.

Table 11. Difference in scientific attitude (Y1) between groups of students using the Moodle learning management system (X1) and groups of students using PowerPoint media (X2)

Independent Samples Test

	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
Equal variances assumed	2.675	.109	2.743	42	.009	6.273	2.287	1.657	10.888
Equal variances not assumed			2.743	36.401	.009	6.273	2.287	1.636	10.909

Based on the results of the Independent Samples Test, data on students' scientific attitudes were compared between the group of students who learned using the LMS Moodle platform and those who learned using PowerPoint media. The analysis yielded a significance value (2-tailed) of 0.009, which is less than 0.05. Therefore, it can be concluded that there is a significant difference in the scientific attitude skills between students who learned using LMS Moodle and those who learned using PowerPoint.

Table 12. Differences in scientific attitude skills between students learning with LMS Moodle media and those learning with PowerPoint media

Group Statistics

Class	N	Mean	Std. Deviation	Std. Error Mean
Experiment	22	77.00	8.950	1.908
Control	22	70.73	5.914	1.261

Based on the Group Statistics table above, it can be observed that the average score for scientific attitude skills of students learning using LMS Moodle is higher than that of students learning with PowerPoint media. The experimental group achieved an average scientific attitude skill score of 77.00, while the control group scored 70.73 on average. Therefore, it can be concluded that the LMS Moodle teaching media is more effective in enhancing the scientific attitude skills of fifth-grade students in science subjects at SDN Demangan.

Based on the results of the Independent Samples Test, data on students' learning motivation were compared between the group of students who learned using LMS Moodle and those who learned using PowerPoint media. The analysis yielded a significance value (2-tailed) of 0.000, which is less than 0.05. Therefore, it can be concluded that there is a significant difference in learning motivation between students who learned using LMS Moodle and those who learned using PowerPoint.

Based on the Group Statistics table above, it can be observed that the average learning motivation score of students using LMS Moodle media is higher than that of students using PowerPoint media. The experimental group achieved an average learning motivation score of 85.36, while the control group scored an average of 79.45. Therefore, it can be concluded that the LMS Moodle teaching media is more effective in enhancing the

learning motivation of fifth- grade students in science subjects at SDN Demangan.

Table 13. Differences in learning motivation (Y2) between the group of students using the learning management system Moodle model (X1) and the group of students using PowerPoint media (X2)

Independent Samples Test

	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Equal variances assumed	.879	.354	3.915	42	.000	5.909	1.509	2.863	8.955
Equal variances not assumed			3.915	39.695	.000	5.909	1.509	2.858	8.960

Table 14. Differences in learning motivation between students learning with LMS Moodle media and those learning with PowerPoint media

Group Statistics

Class	N	Mean	Std. Deviation	Std. Error Mean
Experiment (LMS Moodle)	22	85.36	5.577	1.189
Control (PowerPoint)	22	79.45	4.361	.930

Conclusion

Based on the data analysis, it can be concluded that there is a significant and positive effect of using LMS Moodle on students' scientific attitude skills, as indicated by the t-test result of 11.762 and a significance level of 0.00 < 0.05. Similarly, the use of LMS Moodle also has a significant and positive effect on students' learning motivation, as evidenced by the t- test result of 10.283 and a significance level of 0.00 < 0.05. Furthermore, a significant difference was found in scientific attitude skills between students using the LMS Moodle learning model and those using PowerPoint media, with a (2-tailed) significance level of 0.009 < 0.05. Additionally, a significant difference in learning motivation was observed between the two groups, with a (2-tailed) significance level of 0.00 < 0.05. These findings highlight the effectiveness of LMS Moodle in enhancing both scientific attitude skills and learning motivation among students.

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Author Contributions

R.A.N. contributed to the preparation of the original draft, including the results, discussion, methodology, and conclusion sections; S. responsible for proofreading, reviewing, and editing the manuscript.

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Conflicts of Interest

There is no conflict of interest in this article.

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