Original Research

The Effectiveness of Using WordPress CMS as an Interactive Learning Media on Students' Mathematical Problem-Solving Ability

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ABSTRACT

Students' mathematical problem-solving abilities remain low due to the lack of interactive media and technological limitations in learning. Previous studies have primarily focused on the practicality, validity, and effectiveness of learning media in improving student achievement. This study offers a new contribution by specifically examining the effectiveness of WordPress-based CMS in enhancing students' mathematical problem-solving skills. The research aims to investigate the effectiveness of using WordPress CMS as an interactive learning medium for students at MTs Negeri 11 Cirebon. A quasi-experimental design was employed, involving an experimental group using WordPress CMS and a control group using conventional media. The findings indicate that students' acceptance of the WordPress-based learning media was in the good category (86.32%). There was an increase in post-test scores (86.05) compared to pre-test scores (31.67), with classical mastery reaching 93%. The effect test showed that the use of WordPress CMS had a significant influence on problem-solving ability, contributing 64.6%. An independent sample t-test revealed a significant difference between the experimental and control classes, with an N-Gain of 79.28% (effective) in the experimental group and only 20% (ineffective) in the control group. The study is limited by its sample scope and the specific features of CMS used. The findings suggest that WordPress CMS can serve as an innovative tool in digital mathematics learning, providing a more interactive and effective learning experience. Academically, this study enriches the discourse on digital media development and encourages the integration of CMS platforms into technology-based mathematics instruction.

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1. INTRODUCTION

Mathematical problem-solving skills are essential for developing critical, logical, and analytical thinking (Supriadi et al., 2024). The process includes problem representation, planning, strategy execution, and outcome evaluation (Schäfer et al., 2024). However, these abilities remain low, especially in understanding problems and examining solutions (Ulva & Fitri, 2022). This is supported by the results of the 2022 PISA survey, which shows that Indonesia only obtained an average score of 366 in mathematical literacy, far behind the global average of 472 (OECD, 2023). This is due to the lack of interactive learning

media in mathematics (Apriliana & Nindita, 2023). In addition, learning that does not apply technology results in limited opportunities for students to develop their ability to learn (Subroto et al., 2023). The lack of interactive media and the use of technology in learning make students less active in learning (Ali et al., 2024).

Information technology opens up opportunities for more interactive learning (Lestari et al., 2022). Teachers can use digital platforms to increase learning effectiveness. Teachers can use digital platforms to improve learning effectiveness. One innovation that can be applied is the WordPress CMS (Pandey et al., 2024). Initially, the platform was used to manage content, but it is now expanding for education (Kaluarachchi & Wickramasinghe, 2023). The WordPress CMS is flexible and supports interactive features that enhance student engagement.

The advantages of WordPress lie in its ease of use and ability to manage teaching materials. Interactive quiz features, learning videos, and discussion forums make students more independent and get hands-on feedback (Carr & Barry, 2020; Mutawa et al., 2023). Teachers can create accessible problem-solving questions at any time (Ningrum et al., 2024). With this feature, students are more active in understanding mathematical concepts. Compared to platforms like Moodle, which are more complex to manage, or websites that are limited to interactive features, WordPress offers greater flexibility in plugin integration, visual display, and allows the development of interactive media such as dynamic quizzes, animations, and learning videos in a single system (Khaerunnisa et al., 2019; Mutawa et al., 2023). Therefore, Using WordPress is expected to increase the effectiveness of learning.

Several studies show that WordPress CMS is effective for learning. Husni and Ahmad (2023) found that WordPress is valid, practical, and effective for building volume materials in elementary school. Khaerunnisa et al. (2019) demonstrate that this CMS helps prospective math teachers access and develop learning tools. Anggraini et al. (2024) prove the effectiveness of WordPress in improving student learning outcomes in the pie chart material. Fadilah et al. (2022) found that WordPress improved chemistry learning outcomes in high school. Pratama and Effendi (2021) also states that media based WordPress feasible, practical, and effective as an alternative to learning. However, most of the studies have placed more emphasis on practicality and improving general learning outcomes, rather than specifically examining the influence of CMS WordPress to students' mathematical problem-solving skills. These limitations show that there are research gaps that need to be bridged. Therefore, this study examines the effectiveness of the use of WordPress CMS as an interactive learning medium in improving students' mathematical problem-solving skills. The results of this research are expected to be a reference in the development of more innovative and effective learning technology.

2.   METHOD

This study employs a quantitative approach using a quasi-experimental design, specifically a non-equivalent control group design, in which the experimental class received an intervention in the form of interactive learning media based on WordPress CMS, while the control class received a conventional textbook-based teaching method without interactive features to ensure that any observed differences in outcomes were solely attributable to the use of WordPress CMS. In the experimental class, WordPress CMS was implemented with various interactive features such as dynamic quizzes, instructional videos, and discussion forums, which students accessed regularly to complete mathematical problem-solving tasks aligned with the curriculum, with all activities monitored and assessed as part of the learning evaluation. Both the experimental and control groups were given pre-tests and post-tests to measure changes in mathematical problem-solving abilities. The pre-test and post-test instruments each consisted of eight essay questions with similar types and formats, designed to assess students' mathematical problem-solving skills in the topic of algebraic expressions. The questions were developed based on Polya's four problem-solving stages: understanding the problem, devising a plan, carrying out the plan, and reviewing the results. The difficulty levels of the pre-test and post-test were made equivalent to ensure a fair measurement of skill improvement following the intervention. The study population consisted of seventh-grade students at MTs Negeri 11 Cirebon, with purposive sampling used to select Class VII B as the experimental group and Class VII D as the control group, each consisting of 43 students, based on comparable characteristics and equivalent initial abilities as measured by the pre-test results. Data collection techniques included written test instruments and a Likert-scale questionnaire, both of which were validated using Aiken's validity with results indicating good content validity, and reliability testing showed high reliability, good discriminating power, and appropriate difficulty levels for assessing students' mathematical problem-solving skills. Data analysis involved prerequisite tests (normality and homogeneity), descriptive analysis, and hypothesis testing, including individual and classical mastery tests, effect analysis (linearity, simple linear regression, correlation, and determination), independent t-tests, and n-gain analysis, with the assistance of Microsoft Excel and SPSS 22 software.

3. RESULTS AND DISCUSSION
3.1. Student Response Results

The study collected students' responses to the WordPress CMS through a questionnaire with five aspects: feature suitability, ease of use, interactivity, appearance & motivation, and media effectiveness. The questionnaire results based on student response indicators are shown in Figure 1.
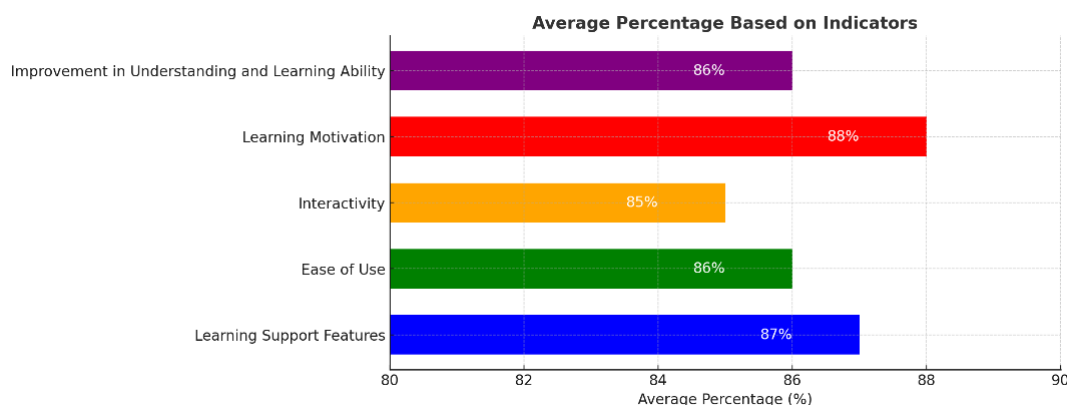

Figure 1. Average Media Usage Response on Each Indicator

The bar chart in Figure 1 depicts the average percentage of student responses across various indicators. The highest percentage was observed in the Learning Motivation aspect (88%), followed by Learning Support Features (87%) and Ease of Use (86%). Improvement of Comprehension and Learning Ability also received a high score (86%), while Interactivity was rated slightly lower at 85%. These results show a generally positive student perception of the WordPress CMS as an interactive learning medium.

3.2. The Impact of Using a WordPress CMS on Students' Mathematical Problem-Solving Abilities

This test measures the understanding and application of mathematical concepts in problem-solving. The results of the analysis are shown in Table 1.

Table 1. Results of Descriptive Analysis of the Test

Statistics	Test scores	Statistics	Test scores
Mean	86,05	Variance	50,99
Median	86,88	Range	28,12
Mode	85,00	Minimum	71,88
Hours of deviation	7,14	Maximum	100,00

The difference in students' learning outcomes before and after the use of the WordPress CMS in the experimental class is illustrated in Figure 2.
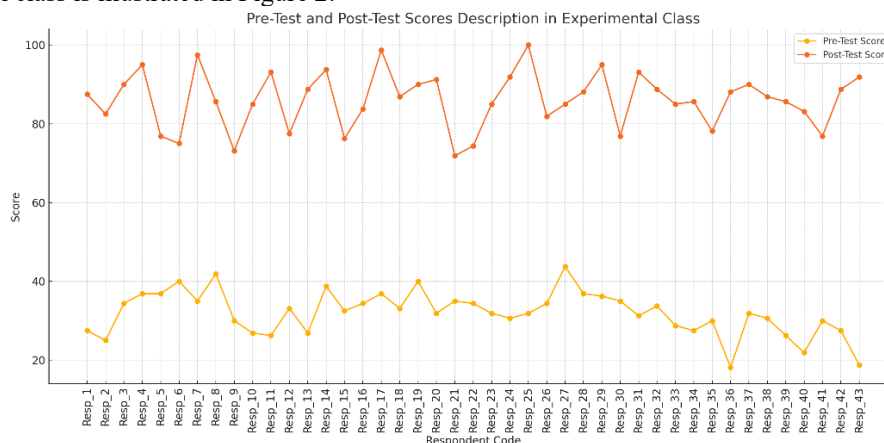

Figure 2. Comparison of Pre-Test and Post-Test Scores in the Experimental Class

The results of the analysis shown in Figure 2 indicate that the mean (86.05), median (86.88), and mode (85.00) were calculated to illustrate the tendency of students' scores. The spread of the value is indicated by the variance (50.99) and the standard deviation (7.14), which suggests a not too large variation in the value. The score range (71.88 – 100.00) shows that all students are in the medium to high category.

3.3. WordPress CMS Effectiveness

3.3.1 Prerequisite Test

Normality Test

The normality test in this study was carried out with Shapiro-Wilk to determine whether the data was normally distributed. The decision is based on the significance value (p-value) with the criteria: if the p-value > 0.05, the data is normally distributed; If the P-value < 0.05, the data is not normally distributed. The results of the normality analysis are presented in Table 2:

Table 2. Normality Test

Group	Phase	Shapiro-wilk	Conclusion
Experiment	Pre-test	0,618	Normally distributed
Experiment	Post-test	0,349	Normally distributed
Control	Pre-test	0,591	Normally distributed
Control	Post-test	0,069	Normally distributed
Questionnaire		0,665	Normally distributed

Based on Table 2, all Shapiro-Wilk test significance values > 0.05, so that the pre-test, post-test, and questionnaire data are normally distributed.

Homogeneity Test

Homogeneity testing with Levene's Test was performed to ensure variance of the control class post-test and homogeneous experiments, using SPSS. The results are presented in Table 3.

Table 3. Homogeneity Test

Group	Levene's test (Mr.)	Conclusion
Post-test experiment & control	0,647	Homogeneity

As shown in Table 3, the Levene's test yielded a significance value of 0.647, which exceeds the threshold of 0.05, indicating that the post-test variances between the experimental and control groups were statistically homogeneous.

3.3.2 Minimum Competency Criteria Test

Individual Minimum Competency Criteria Test

An individual due diligence test was conducted to find out if the students in the experimental class had achieved the Minimum Competency Criteria in mathematical problem-solving abilities using the WordPress CMS. The calculation was performed using SPSS version 22, and the results are presented in Table 4.

Table 4. Descriptive Statistics of Individual Completeness Tests

Statistics	N	Mean	Hours of deviation	Std. Error mean
Mathematics Ability	43	86,05	7,14	1,09

The results of the calculation obtained through a one-sample t-test analysis using SPSS 22 are presented in Table 5:

Table 5. One-Sample T-Test Test Results

Variabel	T-Count	Df	Sig. (2-tailed)	Mean difference	95% confidence interval
Kpmm	10,15	42	0,000	11,05	8,85 – 13,25

Based on the calculation results shown in Table 5, t-calculation = 10.15 was obtained, while t-table = 1.683 at a significance level of 5% with a degree of freedom (df) = 42. Since t-count $\geq$ t-table (10.15 $\geq$ 1.683), H_0 is rejected and H_1 is accepted. Thus, it can be concluded that students' problem-solving skills have reached the Minimum Competency Criteria, with a total of 40 students who have reached the Minimum Competency Criteria.

Classical Minimum Competency Criteria Test

A classical completeness test is carried out to determine whether $\geq$ 80% of students have achieved the Minimum Competency Criteria. This analysis uses a one-sided Z-test (left-sided) with decision-making criteria: if Z-calculates $\geq$ Z-table, then H_0 is rejected and H_1 is accepted, while if Z-calculates $\leq$ Z-table, then H_0 is accepted and H_1 is rejected.

$$z = \frac{\frac{x}{n} - \pi_0}{\sqrt{\frac{\pi_0(1 - \pi_0)}{n}}} = \frac{\frac{40}{43} - 0{,}8}{\sqrt{\frac{0{,}8(1 - 0{,}8)}{43}}} = \frac{0.9302 - 0{,}8}{\sqrt{\frac{0.16}{43}}} = \frac{0.1302}{0.061} = 2.14$$

Z-count = 2.14 was obtained, while Z-table = 0.6736 at a significance level of 5%. Since Z-count ≥ Z-table (2.14 ≥ 0.6736), H₀ is rejected, so that the experimental class has reached classical completeness of 93%.

3.3.3 Influence Test

Linearity Test

Before the linear regression test, a linearity test is carried out to ensure that the data relationship is linear. Test criteria: if sig < 0.05, the data is non-linear; If the GIS > 0.05, the data is linear.

Table 6. Linearity Test

Anova table			Sum of squares	Df	Mean square	F	Itself.
Mathematics Ability use of WordPress cms	Between groups	(combined)	1801,390	20	90,070	5,827	,000
		Linearity	1383,555	1	1383,555	89,506	,000
		Deviation from linearity	417,835	19	21,991	1,423	,212
	Within groups		340,070	22	15,458		
	Total		2141,460	42			

As shown in Table 6, the significance value for the deviation from linearity was 0.212. Since this value exceeds 0.05, it can be concluded that the relationship between the use of WordPress CMS media and students' mathematical problem-solving abilities is linear.

Simple Linear Regression Test

The regression test measures the effect of using the WordPress CMS (X) on the mathematical problem-solving ability of students (Y). The regression equation was obtained using SPSS 22.

Table 7. Simple Linear Regression Test

Coefficientsa					
Model	Unstandardized coefficients		Standardized coefficients	T	Itself.
	B	Std. Error	Beta		
1 (constant)	16,563	8,058		2,055	,046
Use of WordPress CMS	,805	,093	,804	8,651	,000
A. Dependent variable: kpmm					

A simple linear regression model uses the formula $\hat{Y} = a + bX$, where Y represents the post-test score and X represents the students' responses to the WordPress CMS. Based on Table 7, the values obtained were a = 16.563 and b = 0.805, so the resulting regression equation is:

$$\hat{Y} = 16{,}563 + 0{,}805X$$

Based on the regression equation, every 1% increase in WordPress CMS usage increases a student's mathematical problem-solving ability by 0.805. The positive regression coefficient shows a unidirectional relationship between the two variables. With a significance value of 0.000 (< 0.05), it can be concluded that the use of a WordPress CMS has a significant effect on students' mathematical problem-solving skills.

Correlation Test

The correlation coefficient was used to test the relationship between the use of the WordPress CMS and the mathematical problem-solving ability of students. The analysis conducted using SPSS version 22 yields the results presented in Table 8:

Table 8. Correlation Test

Correlations		Kpmm	Use of WordPress cms
KPMM	Pearson correlation	1	,804**
	Sig. (2-tailed)		,000
	N	43	43
Use of WordPress cms	Pearson correlation	,804**	1
	Sig. (2-tailed)	,000	
	N	43	43
**. Correlation is significant at the 0.01 level (2-tailed).			

A significance value of 0.000 (< 0.05) was obtained, indicating a significant relationship. A Pearson Correlation value of 0.804 indicates a very strong and positive correlation, meaning that the higher the use of the WordPress CMS, the higher the mathematical problem-solving skills of the students.

Determination Test

The determination coefficient test (R-Square) measures the effect of using a WordPress CMS on a student's mathematical problem-solving ability. The results of the analysis conducted using SPSS version 22 are presented in Table 9:

Table 9. Determination Test

Model	R	R square	Adjusted r square	Std. Error of the estimate
1	0,804	0,646	0,637	4,29948

An R-Square value of 0.646 indicates that the use of a WordPress CMS contributes 64.6% to a student's mathematical problem-solving ability. Based on the criteria, this value falls into the Strong category.

3.3.4 Average Difference Test

The independent sample t-test was conducted to test the difference in mathematical problem-solving ability between classes that use the WordPress CMS and those that do not. The results of the analysis conducted using SPSS version 22 are presented in Table 10:

Table 10. Uji T Independent Sample t-test

Group	T-Count	Df	Sig. (2-tailed)	Conclusion
Post-test experiment & control	25,303	84	0,000	Significant differences

The value of sig. (2-tailed) = 0.000 < 0.05, so Ha is accepted, showing a significant difference in students' mathematical problem-solving abilities between classes that use the WordPress CMS and those that don't. In addition, since t-count (25,303) > t-table (1,663), the null hypothesis is rejected, corroborating the conclusion that the use of a WordPress CMS has a significant impact.

3.3.5 Uji N-Gain

The effectiveness of using WordPress CMS media on students' mathematical problem-solving abilities can be observed through the increase in pre-test and post-test scores in both the control and experimental classes, as presented in Table 1:

Table 11. Control and Experimental Class N-Gain Test

N-gain	N-gain skor	N-gain score (percentage)	Category
Experimental class	0,7928	79,28%	Effective
Control class	0,2	20%	Ineffective

The results presented in Table 11 can be visualized in the form of the following graph:
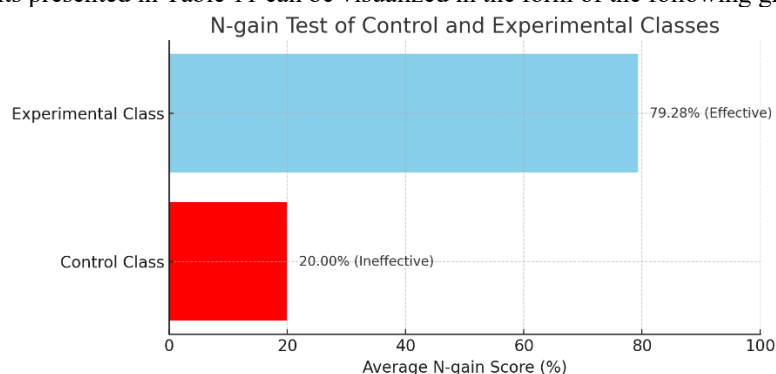

Figure 3. Difference in Average N-Gain Score

Based on Figure 3, the effectiveness of using the WordPress CMS was measured through the N-Gain score, which averaged 79.28% and falls into the Effective category. Therefore, the WordPress CMS has proven to be effective in improving students' mathematical problem-solving abilities.

3.6. Discussion

The results of this study showed a significant increase in students' mathematical problem-solving abilities after using the WordPress CMS. This improvement can be explained pedagogically and psychologically by several factors. The interactive features of WordPress, such as quizzes, discussion forums,

H5P, and MathJax-LaTeX, provided active learning opportunities that encouraged students to repeatedly engage with the material. According to Bruner's constructivist theory (Bruner, 1960), students learn more meaningfully when they actively construct their own knowledge through experience and exploration. Features such as quizzes support this process by promoting repeated practice and self-reflection, which strengthens long-term memory (Mayer, 2024).

In addition, discussion forums in WordPress allowed students to interact socially, exchanging ideas and negotiating meaning, consistent with Vygotsky's social constructivism (Vygotsky's, 2003) that emphasizes learning through social interaction. The MathJax-LaTeX tools helped students visualize mathematical structures clearly, reducing cognitive overload and improving their ability to represent and solve problems systematically, in line with Polya's problem-solving model (Polya, 1957). Mayer's multimedia learning theory (Mayer, 2024) also supports this finding by stating that the integration of text, images, and interactive elements activates deeper cognitive processes and improves engagement.

When compared with previous empirical studies, these findings are in line with research by Husni and Ahmad (2023), who reported that WordPress was valid, practical, and effective for building volume materials in elementary school. Similarly, Khaerunnisa et al. (2019) showed that WordPress helped prospective mathematics teachers develop and access teaching tools more efficiently. Anggraini et al. (2024) demonstrated that WordPress effectively improved learning outcomes in pie chart material, while Fadilah et al. (2022) proved its effectiveness in enhancing chemistry learning outcomes in high school. In the same vein, Pratama and Effendi (2021) concluded that WordPress-based media is feasible, practical, and effective as an alternative to digital learning. Therefore, the current study further strengthens the evidence that WordPress can improve learning outcomes across subjects, including mathematics.

Looking more specifically at the learning process, the discussion forum feature fostered collaboration and peer-to-peer learning, enabling students to explain and debate mathematical solutions with each other. The H5P-based formative quizzes supported immediate feedback and self-assessment, helping students identify mistakes and correct their problem-solving strategies. Moreover, MathJax-LaTeX supports better comprehension of mathematical formulas and symbolic notation, addressing students' difficulties in representing abstract algebraic ideas.

However, this learning process also faced several limitations. Some students experienced internet connectivity issues that disrupted their access to the WordPress platform, especially during peak hours. A few participants needed technical assistance when logging in or navigating the system, which initially reduced their learning efficiency. Furthermore, not all students actively engaged in the discussion forums, possibly due to a lack of confidence or unfamiliarity with online collaborative environments. These challenges suggest that future implementations should provide better user training, technical support, and strategies to encourage active participation. In line with Miarso (2011), the ease of use and interactivity of WordPress CMS can stimulate students' attention and understanding, while the observed improvement in problem-solving abilities supports Wena's (2009) explanation that problem-solving is an active cognitive process requiring appropriate strategies and supportive media. Overall, the findings highlight how the use of WordPress CMS as an interactive, student-centered technology can effectively improve mathematical problem-solving skills and support meaningful learning experiences.

4. CONCLUSION

The use of WordPress CMS as an interactive learning medium has been proven to be effective in improving students' mathematical problem-solving skills at MTs Negeri 11 Cirebon, with positive acceptance from students (86.32%), a significant increase in post-test scores (86.05) compared to pre-test (31.67), most students achieved a score of 71.88–100.00 with an even distribution in the medium to high category, and the completeness of individual and classical KKM was 93%. Statistically, the WordPress CMS had a significant influence on the mathematical problem-solving ability, with a contribution of 64.6%, the analysis of the average difference test revealed a significant difference between the experimental and control classes (t = 25.303; p < 0.000), with the experimental class's N-Gain reaching 79.28% (Effective) compared to the control class of 20% (Ineffective). The limitation of this study is that it has not measured the long-term effects of using the WordPress CMS on students' abilities after the learning ends. Therefore, schools and teachers are advised to integrate the WordPress CMS in learning, provide training for teachers, and utilize interactive features to improve learning effectiveness. Students are expected to be more active in using the WordPress CMS to access materials and participate in interactive exercises. Further research is recommended to evaluate the long-term effects of using a WordPress CMS, develop additional features such as gamification or automated reporting, and compare the effectiveness of the WordPress CMS with other digital platforms such as Moodle.

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