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Reog Ponorogo-Based Discovery Learning to Enhance Science Motivation and Cognitive Abilities of Junior High School Students

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Abstract

A person's success in achieving educational competencies is influenced not only by intellectual factors but also by non-intellectual factors, such as learning motivation. Cognitive ability is another essential component of successful science learning. However, students' learning motivation and cognitive abilities in science remain relatively low. Therefore, this study aimed to improve students' learning motivation and cognitive abilities through the implementation of a local wisdom-based discovery learning model. A pre-experimental study employing a one-group pretest-posttest design was conducted. Learning motivation was measured using a questionnaire, cognitive abilities were assessed through pre-test and post-test instruments, and learning implementation was evaluated using an observation sheet. The data were analyzed using N-Gain and the Wilcoxon signed-rank test. Results showed significant improvements in both learning motivation and cognitive abilities after the implementation of the learning model (Wilcoxon, $p < 0.001$). The N-Gain score for learning motivation was 0.67 (medium), while the N-Gain score for cognitive abilities was 0.54 (medium). The average implementation of learning across three meetings reached 92%, indicating excellent implementation fidelity. This study contributes empirical evidence by demonstrating the effectiveness of integrating Reog Ponorogo local wisdom into the discovery learning model to enhance students' learning motivation and cognitive abilities in Indonesian junior secondary science education. These findings suggest that integrating local cultural contexts into science instruction can serve as an effective strategy for improving students' learning outcomes.

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INTRODUCTION

An important factor in a country's progress is education, as high-quality education fosters superior human resources (Van Hiep, 2021). In alignment with rapid advancements in science and technology, adjustments to educational paradigms, particularly within science instruction are essential to equip younger generation with capacity to confront and navigate future challenges (Srivastava, 2023). Educational success is profoundly influenced by the learning processes that occur during instruction (Oktania et al., 2025). Within educational landscape, an individual's achievement of such competencies is determined not only by intellectual factors but also by equally critical non-intellectual factors, self motivation.

This is consistent with (Goleman, 2001) assertion that intelligence quotient (IQ) accounts for only 20% of success, while the remaining 80% is determined by other factors, particularly emotional intelligence (EQ), which includes the ability to motivate oneself. This is consistent with Goleman's (2001) assertion that intelligence quotient (IQ) accounts for only 20% of success, while the remaining 80% is determined by other factors, particularly emotional intelligence (EQ), which includes the ability to motivate oneself. Learning motivation is an indispensable variable in the instructional process (Laswadi et al., 2023). It is defined as an internal drive within students that evolves through the learning process, thereby ensuring the continuity and persistence of level burning activities (Tritana et al., 2025).

Interactive science instruction-integrating observation, experimentation, phenomenon-based problem solving-requires substantial learning motivation (Laswadi et al., 2023). Such motivation improves learning experience, rendering science education more engaging and intrinsically rewarding (Sari et al., 2022; Ulfaa et al., 2025). The success of science instruction is largely contingent upon students' cognitive abilities.

Cognitive ability represents a core objective of the instructional process and serves as a fundamental dimension of learning outcomes (Susilawati et al., 2023).The intellectual domain includes educational results organized into six levels of hierarchy: awareness, understanding, usage, examination, creation, and assessment (Noor et al., 2020). In essence, cognitive ability refers to the mental capacity for reasoning and acquiring understanding through the learning process. High levels of learning motivation compel students to engage more rigorously in their studies, subsequently yielding superior academic outcomes (Oktania et al., 2025). Therefore, fostering motivation in science education is imperative, as it directly influences students' cognitive abilities (Idris et al., 2023).

Empirical observations reveal that student learning motivation remains suboptimal in practical instructional settings. Based on preliminary data collected at State Junior High School 1 Jetis Ponorogo, the average motivation score was recorded at 44%. Further analysis of the ARCS dimensions showed that the highest score was 48% for attention, while the lowest was 38% for satisfaction. Additionally, the relevance and confidence dimensions reached 46% and 42%, respectively. The aforementioned data indicate that learning motivation at the school remains categorized as low. Furthermore, the average formative assessment score for Vibrations and Waves in a specific class was recorded at 56, which falls significantly below the Minimum Mastery Criterion of 75. Consequently, it can be inferred that students' cognitive abilities in science instruction is still suboptimal, as it consistently fails to meet the established proficiency standards.

This was brought on by internal causes, specifically a lack of student interest in science study, according to the findings of interviews conducted with science teachers and students in class VIII B at State Junior High School 1 Jetis Ponorogo. Most students were less interested in science because from the beginning, before studying it, they had already instilled in their minds that science learning was difficult. They believe that science lessons tend to be boring, with abstract, complex, and difficult to understand material. Science lessons become less meaningful to their socio-cultural lives. Therefore, strategies and learning models are needed to improve student motivation, which can impact their cognitive abilities. This has resulted in low motivation for science learning.

Student learning motivation can be improved through the implementation of innovative learning, one of which is the discovery learning model . Students' thought patterns (cognitive), attitudes (affective), and behaviors (psychomotor) are influenced by their surroundings (Noor et al., 2020). The local wisdom, closely related to their surroundings, can also influence thought patterns (cognitive), attitudes (affective), and behavior (psychomotor). Therefore, learning that connects regional culture with science is essential (Sugiantoro et al., 2024). The discovery learning linked to local wisdom can help students apply learning in their daily lives, making learning more meaningful and improving their desire to learn (Billa et al., 2025; Khusna & Adji, 2024).

Research related to the local wisdom-based discovery learning model is based on several relevant studies, especially research conducted by (Ningtyas & Setiawan, 2023), which shows that the implementation of local wisdom-based discovery learning improves student motivation and learning outcomes. In line with the motivational theory of Self Determination Theory (Oszwa & Marii, 2023), it claims that when people have a connection to the subject matter being taught, they are more driven to learn.

Based on several previous studies, the discovery learning model and the local wisdom, are successful in improving student motivation and learning outcomes. Although numerous studies have integrated local wisdom into science learning, they have predominantly focused on the local wisdom of other regions. To date, no study has specifically incorporated Reog Ponorogo, a distinctive form of local cultural heritage into science instruction. Furthermore, previous studies that combined local wisdom with virtual laboratory activities generally used local wisdom only as contextual enrichment rather than integrating it directly into the learning process. This gap highlights the need to develop and examine science learning that explicitly incorporates Reog Ponorogo as the basis for learning activities.

According to the findings of Interviews conducted with students at a junior high school in Ponorogo revealed that physics is often perceived as difficult to understand, which may reduce students' motivation to learn science. Therefore, the topic of vibrations and waves was selected because it can be meaningfully integrated with the local wisdom of Reog Ponorogo within a discovery learning model. Although previous studies have explored vibrations and waves in the context of local wisdom, limited research has investigated the integration of Reog Ponorogo local wisdom into discovery learning to enhance both learning motivation and cognitive abilities. Therefore, this study aims to investigate whether the implementation of a discovery learning model based on the local wisdom of Reog Ponorogo can improve students' learning motivation and cognitive abilities. Accordingly, this study hypothesizes that the implementation of a discovery learning model based on the local wisdom of Reog Ponorogo significantly improves students' learning motivation and cognitive abilities.

METHOD

This study employed a quantitative approach using a pre-experimental one-group pretest-posttest design (Fraenkel et al., 2023). The research participants consisted of one class, Class VIII B at State Junior High School 1 Jetis Ponorogo, Indonesia. This class was selected based on preliminary findings indicating low levels of learning motivation and cognitive abilities. The learning intervention utilized science learning materials developed based on the local wisdom of Reog Ponorogo, including lesson modules, student worksheets (LKM), and learning media.

The tools utilized in this research consist of a survey on learning motivation modified from (Nurandini et al., 2024). This checklist-style instrument comprises 20 items, consisting of both positive and negative statements categorized under the Attention, Relevance, Confidence, and Satisfaction (ARCS) dimensions. The survey employs a Likert scale. The instruments also include a cognitive assessment test to measure student proficiency levels. Additionally, a learning observation sheet was utilized to evaluate the teacher's instructional activities, categorized into three phases: preliminary, core, and closing activities. These phases are aligned with the specific syntax of the discovery learning model to assess the fidelity of the model's implementation. A cognitive assessment test was also administered to measure students' cognitive abilities levels. The learning materials and research instruments underwent expert judgment to assess their content validity before implementation. Based on the experts' evaluation, the instruments were considered appropriate for use in this study.

Methods for gathering data in this research included the use of a questionnaire to evaluate learning motivation before and after the intervention, observations of the classroom carried out by three unbiased observers, and the implementation of assessments before and after the intervention to measure cognitive abilities. The resulting cognitive data were analyzed to evaluate improvements in student performance. Specifically, the analysis of N-gain was utilized to determine the enhancement of learning motivation and cognitive abilities after intervention. These criteria are used to categorize and interpret N-gain results:

Table 1. Criteria for Normalized N-Gain Scores

N-Gain Score	Category
$0.7 \leq g \leq 1.0$	High
$0.3 \leq g < 0.7$	Medium
$0.0 < g < 0.3$	Low

(Hake, 1998)

The quantitative analysis of learning implementation was conducted by calculating the scores for each aspect based on the criteria of very good, good, sufficient, less than good. The calculated mean scores were subsequently converted into learning implementation criteria scores. The standards for assessing the execution of the learning process are outlined as follows:

Table 2. Evaluation Criteria for Learning Implementation

Percentage (%)	Average Score Criteria
1-20	Very Poor
21-40	Poor
41-60	Fair
61-80	Good
81-100	Excellent

(Riduwan, 2016)

Data collected from learning motivation before and after the intervention, as well as test results before and after the intervention, were subsequently subjected to hypothesis testing. The normality assessment is a statistical method that assesses if the data set conforms to a normal distribution. His assessment was performed utilizing SPSS 27 software to confirm the accuracy of the results. Based on (Sugiyono, 2019) the normality test's requirements are as follows: if the p-value is larger than 0.05 ($p > 0.05$), the data exhibits a normal distribution; if the p-value is less than 0.05 ($p < 0.05$), the data does not exhibit a normal distribution. When the data has a normal distribution, a Paired Sample T-Test will be employed. However, if the data does not fit a normal distribution, a non-parametric method called the Wilcoxon Signed-Rank Test will be used.

RESULT AND DISCUSSION

At State Junior High School 1 Jetis Ponorogo, the application of the local wisdom-based discovery learning for the subject of vibrations and waves took place over three sessions. The results of a motivation questionnaire given both before and after the study were used to determine how many students were motivated to learn. This questionnaire contained twenty statements based on the four aspects of the ARCS motivation model: attention, relevance, confidence, and satisfaction.

Because there were 35 students in the sample who answered the learning motivation questionnaire both before and after the classes, data normality was examined using SPSS software, specifically the Shapiro-Wilk test. Table 3 below displays the normalcy test results.

Table 3. Normality Test Learning Motivation

	Shapiro-Wilk		
	Statistic	df	Sig
Pre-test Learning Motivation	0.886	35	*0.002*
Post-test Learning Motivation	0.935	35	*0.041*

Both before and after the lesson, the learning motivation data had a significant value ($p < 0.05$), indicating that the data did not meet the assumption of normality. Therefore, the hypothesis was tested using the non-parametric Wilcoxon test. signed-rank test. The results of the Wilcoxon test are shown in Table 4 below.

Table 4. Wilcoxon Signed-Rank Test Results Learning Motivation

	Post-test Learning Motivation Pretest Learning Motivation
Z	-5.163^b
Asymp. Sig. (2-tailed)	*<.001*

The Wilcoxon test results, conducted using SPSS software, produced an asymptotic significance value (2-tailed) <0.001. Student learning motivation after the instruction was significantly higher than before the instruction, as the resulting p-value was below the established significance threshold ($p < 0.05$). These results indicate a significant difference in student learning motivation before and after the implementation of the local wisdom-based discovery learning model.

The improvement in student learning motivation is supported by data on the implementation of learning which always improves at each meeting, which can be seen in Table 5.

Table 5. Percentage of Learning Implementation per Meeting

Meeting	Learning Implementation	Category
1	90%	Excellent
2	92%	Excellent
3	94%	Excellent
Average	92%	Excellent

The average learning motivation scores before and after instruction for each aspect were compared to determine improvement. Table 6 below displays the N-Gain analysis's findings.

Table 6. Results of Pre-test and Post-test N-Gain Analysis

Aspect	Pretest	Posttest	N-Gain	Category
Attention	46	83	0.68	Medium
Relevance	48	83	0.67	Medium
Confidence	44	84	0.71	High
Satisfaction	47	81	0.64	Medium
Average			0.67	Medium

Table 6 shows that the percentage of learning motivation has improved in all areas, falling into the medium and high categories. The confidence component has the largest percentage of learning motivation. This occurs because discovery learning provides space for students to explore and discover concepts independently; consequently, students feel capable of understanding the material and completing learning tasks, which ultimately improves their self-confidence (Safira & Savitri, 2022; Syadevi et al., 2025). Supported by data on the implementation of the Discovery Learning model for each phase in Figure 1 below.

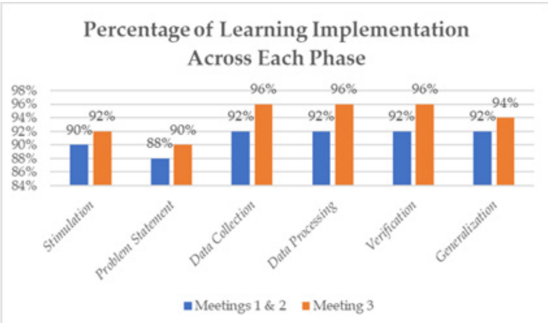

Figure 1. Percentage Graph of Learning Implementation

Based on figure 1, the data collection, data processing, and verification phases experienced the highest improvement in learning implementation among the other six phases. This was because, during these stages, students were directly and actively involved in the process of concept discovery, making the learning experience more meaningful and memorable (Ningtyas & Setiawan, 2023). This aligns with the constructivist theory of learning proposed by (Piaget, 1970), which holds that active, collaborative, and contextual learning enables students to better understand concepts and remain motivated to learn, as they feel directly involved in the process of knowledge construction.

Furthermore, students' active involvement in observations, discussions, and presentations triggers a strong sense of self-efficacy, thereby improving the confidence aspect during the learning process (Syaifullah & Prasetyo, 2025). As evidenced by the data on the implementation of the discovery learning model, in the generalization phase the learning implementation category was excellent and improved with each meeting. This was evident as several groups presented their findings, with students enthusiastically exchanging opinions with other groups. Furthermore, when a presenting group was unable to answer questions, the teacher intervened to provide the correct explanation and clarification. Consequently, a highly positive interaction occurred during this phase. The high levels of student motivation and cognitive ability were also influenced by the well-executed treatment during the learning process (Mülbe et al., 2024). During the lessons, the teacher encouraged students to interact with their group members through discussion, thereby making them more active and better able to comprehend the material provided.

This aligns with research by (Syadevi et al., 2025), which reveals that the generalization phase in discovery learning reaches an optimal point when the teacher serves as a dialogic bridge, capable of transforming student debates into a constructive concept validation process through reinforcement. Furthermore, (Suryani, 2023) emphasizes that an appreciative classroom atmosphere during the presentation of local wisdom outcomes (such as the vibrations of the Gong Reog) makes students feel personally and culturally valued. This self-confidence triggers an increase in active participation, which is reflected in high implementation scores. In line with this, (Handayani & Wijaya, 2024) explain that multidirectional interaction (student-student-teacher) at the final stage of learning is highly effective for anchoring abstract conceptual understanding, ensuring that the transition from local experiences to universal physics laws is well-received by all students.

Meanwhile, the learning motivation aspect with the lowest percentage was satisfaction. This condition indicates that active involvement in learning is not always directly proportional to the emergence of learning satisfaction, particularly when students' conceptual understanding remains diverse (Sucipto et al., 2025). This result aligns with the findings of (Hyun et al., 2017) which state that student learning satisfaction is influenced by the level of success in understanding the material, rather than merely by active participation during the learning process.

According to (Keller, 1987), satisfaction is defined as the ultimate outcome of students' subjective evaluations regarding their success. The low level of this aspect is rationally attributed to the cognitive adaptation process, specifically the transition from conventional instruction to discovery learning, which necessitates a high degree of learner autonomy. When students exert substantial effort to comprehend complex concepts, satisfaction emerges incrementally rather than instantaneously (Fang et al., 2024). This indicates that students require reflective reinforcement to effectively internalize the significance of their learning experiences These findings are consistent with those of (Sadri & Temaja, 2025), who claim that incorporating local wisdom into education must be accompanied by reflection and the reinforcement of meaning to improve student learning satisfaction.

The improvement in learning motivation in this research was consistent with the improvement in students' cognitive abilities, which are a component of learning outcomes. This is demonstrated by the N-Gain analysis of the pretest and posttest, as shown in Table 7 below.

Table 7. N-Gain Results for Students' Cognitive Ability

N-Gain Range	Category	Number of students	(%)
$0.7 \leq g \leq 1.0$	High	10	29
$0.3 \leq g < 0.7$	Medium	25	71
$0.0 < g < 0.3$	Low	0	0
Average N-Gain		0.54 (Medium)	

The data reveals that the average rise in student learning motivation is in the medium range. This research also used a normality test to look at the distribution of the pre-test and post-test scores. The normalcy test results are shown in Table 8 below.

Table 8. Normality Test Results Cognitive Abilities

	Shapiro-Wilk		
	Statistic	df	Sig
Pretest	.867	35	*<.001*
Posttest	.871	35	*<.001*

For both the pre-test and post-test data, the results of the normality test using SPSS software showed significant values of less than 0.001 (less than 0.05). This implies that the normality assumption was not met by the pre-test and post-test data distributions. Consequently, the Wilcoxon signed-rank test, a non-parametric test, was used. Table 9 below displays the Wilcoxon Signed-Rank Test results.

Table 9. Wilcoxon Signed-Rank Test Results Cognitive Abilities

	Posttest-Pretest
Z	-5.207[b]
Asymp. Sig. (2-tailed)	*<.001*

The Wilcoxon test results, conducted using SPSS software, produced an asymptotic significance value (2-tailed) <0.001. Student cognitive abilities after the instruction was significantly higher than before the instruction, as the resulting p-value was below the established significance threshold ($p < 0.05$). These results indicate a significant difference in student cognitive abilities before and after the implementation of the local wisdom-based discovery learning model.

The findings indicate that implementing the local wisdom-based discovery learning model improved students' learning motivation and cognitive abilities. This finding is consistent with (Bachtiar et al., 2025; Widana & Handayani, 2022), who reported that discovery learning actively engages students in constructing knowledge through exploration and problem-solving activities. Likewise, (Ledang et al., 2024) found that integrating local wisdom into discovery learning significantly improved students' science learning outcomes and scientific attitudes because students were able to relate scientific concepts to familiar cultural contexts.

The improvement observed in this study can be explained by the integration of Reog Ponorogo local wisdom into the discovery learning process. During the learning activities, students explored concepts of vibrations and waves through examples found in Reog Ponorogo performances, enabling them to connect abstract scientific concepts with real cultural phenomena. Classroom observations showed that students actively discussed, formulated hypotheses, and verified scientific concepts based on these cultural examples. This contextual learning encouraged greater participation and curiosity because the learning materials were closely related to students' daily experiences. Similar findings were reported by (Aprilia et al., 2025), who concluded that ethnoscience-based contextual learning increases students' engagement and conceptual understanding by making science more meaningful and culturally relevant. High learning motivation will encourage students to study harder and achieve better learning outcomes (Oktania et al., 2025).

Furthermore, integrating local wisdom into science instruction provided meaningful learning experiences by connecting scientific knowledge with students' cultural identities. Rather than learning the concepts of vibrations and waves solely through textbook explanations, students were able to observe how these concepts are represented in traditional Reog Ponorogo performances. This contextualization facilitated knowledge construction because students could associate new scientific concepts with their existing cultural experiences, thereby reducing the difficulty of understanding abstract concepts. In addition, contextual learning encouraged students to appreciate local cultural heritage while simultaneously developing scientific understanding. These findings are supported by (Verawati & Wahyudi, 2024), who reported that integrating local wisdom into science learning significantly enhances students' scientific literacy by making scientific concepts more contextual, meaningful, and culturally relevant. Likewise, (Syaifullah & Prasetyo, 2025) argued that local wisdom-based science learning enriches students' learning experiences and promotes both scientific understanding and cultural awareness.

The excellent implementation of the learning process (92%) also contributed to these outcomes. Effective implementation ensured that every phase of the discovery learning model from stimulation and problem identification to data collection, verification, and generalization was implemented consistently. Classroom observations showed that students actively collaborated in group discussions, analysed scientific phenomena represented in Reog Ponorogo performances, exchanged ideas, and verified their findings through guided inquiry. These learning experiences created an active and meaningful classroom environment that strengthened students' motivation while facilitating conceptual understanding. Similar findings were reported by (Munafiroh et al., 2024), who found that integrating local wisdom into discovery learning significantly improved students' problem-solving abilities because contextual cultural experiences enabled learners to construct knowledge more effectively. This finding is also in line with (Ningtyas & Setiawan, 2023), who reported that ethnoscience-based discovery learning creates a more enjoyable classroom atmosphere, increases students' motivation, and improves learning outcomes.

These findings also reinforce recent evidence that integrating local wisdom into science instruction enhances students' scientific literacy, engagement, and understanding by linking classroom learning with authentic cultural experiences. (Sari et al., 2026) emphasized that culturally contextualized science instruction strengthens students' participation and scientific literacy while fostering appreciation of local culture.

CONCLUSION

Based on the research findings, the implementation of the local wisdom-based discovery learning model improved students' learning motivation and cognitive abilities. Learning motivation increased with an N-Gain score of 0.67 (moderate category), while cognitive abilities improved with an N-Gain score of 0.54 (moderate category). The Wilcoxon signed-rank test indicated significant differences between the pre-test and post-test scores for both learning motivation and cognitive abilities ($p < 0.001$). In addition, the implementation of the learning model across three meetings achieved an average implementation rate of 92%, indicating excellent implementation fidelity. This study contributes empirical evidence that integrating Reog Ponorogo local wisdom into the discovery learning model is an effective contextual learning approach for enhancing students' learning motivation and cognitive abilities in Indonesian junior secondary science education.

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