

Application of Local Wisdom-Based Discovery Learning Model to Improve Students' Critical Thinking Skills

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ABSTRACT

Education should produce human resources who have competencies in the 21st century. One of the 21st-century skills students need to have is critical thinking skills. This study aims to analyse three aspects: the improvement of students' critical thinking skills, the implementation of learning, and student responses to the application of the discovery learning model based on local wisdom in the material of separating mixtures. This type of research utilized descriptive-quantitative methods. The subjects of this research were students of grade 8A MTs Negeri 2 Situbondo. There are observation methods, tests, and response questionnaires. The results of this study indicate that the application of the discovery learning model can improve students' critical thinking skills, as indicated by an N-Gain score of 0.73, which meets high criteria. The implementation of learning using this model yielded a percentage result of 91.62% at the first meeting and 95.37% at the second meeting, both in the very good category. Student responses to learning showed very good results, a total percentage of 92% with very high criteria. These findings suggest that the discovery learning model, grounded in local wisdom, effectively enhances students' critical thinking skills, ensures well-implemented learning, and receives positive feedback from students. These results not only support local contextual learning but also contribute to global science education by showing that integrating cultural relevance can enhance critical thinking in diverse classroom settings.

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INTRODUCTION

In the 21st century, science and technology have undergone rapid development in tandem with the changing times (Yunita & Mandasari, 2025; Siregar, 2020). One important aspect of life is education, where the development of students' mindsets is an urgent need that must be met in this era of globalization (Mardhiyah et al., 2021). Students must possess four essential skills to meet the demands of globalization, known as the 4C: Communication, Collaboration, Critical Thinking, and Creativity (Paliha & Andriany, 2024; Nurhayati et al., 2024). The application of 4C skills in the learning process has been proven to increase active student involvement, foster curiosity, strengthen problem-solving skills, and foster a tolerant attitude in group work (Partono et al., 2021; Yuliana & Irawan, 2024). Therefore, education must move toward learner-centered approaches that emphasize the development of these competencies.

Critical thinking is one of the essential competencies required to address the challenges of the 21st century (Defiyanti & Sumarni, 2019; Ramadani et al., 2025). In terms of education, critical thinking skills are essential for students to master. Students who possess these skills will be better able to grasp the concepts and problems presented in learning and apply these concepts to real-life situations. Critical thinking skills are also a determining factor in students' success in exams and tests

(Ariadila et al., 2023; Jamaludin et al., 2023). Regulation of the Minister of National Education Number 22 of 2006 (BNSP, 2006) emphasizes that critical thinking skills are essential for students to manage and utilize information effectively in conditions that are constantly changing, uncertain, and competitive.

The critical thinking skills of Indonesian students are still below international standards. According to the PISA (Programme for International Student Assessment) study in 2022 (OECD, 2023). The results of PISA 2022 indicate a decline in the performance of Indonesian students in three main areas: reading, mathematics, and science, with average scores dropping by 12–13 points compared to 2018. In the reading field, only 25% of students were able to reach level 2. Meanwhile, in OECD countries, 74% of students achieved this level. Worse still, almost no Indonesian students reached level 5. In mathematics, only 18% of students reached level 2, which is the ability to represent simple situations mathematically. In science, around 34% of students were able to recognize correct scientific explanations. Almost no Indonesian students reached levels 5 and 6, which include creativity and independence in applying scientific knowledge to unfamiliar situations. As many as 7% of students in OECD countries can reach this level. The results of PISA 2022 show that Indonesia is lagging behind OECD countries (OECD, 2023).

Similar conditions were seen in one of the schools in grade 8. Based on the results of the critical thinking ability test, the indicators of providing simple explanations, building basic skills, concluding, and making further explanations obtained percentages of 41%, 28%, 28%, and 31%, respectively. A total of 20 students worked on 10 questions; only one student achieved a score above 60, while 19 other students scored below 50. There are three categories for students' critical thinking ability levels, with a value of $x \leq 60$ categorized as a low ability level, a value of $60 < x \leq 75$ categorized as a medium ability, and a value of $75 < x \leq 100$ categorized as a high ability (Rosmalinda et al., 2021). Based on the reference, the results of the critical thinking ability test are still relatively low, as the obtained results are below 60. Therefore, it is necessary to improve the critical thinking skills of grade VIII students at MTS Negeri 2 Situbondo. Based on the interview results, teachers also stated that the teaching methods they use are still conventional and do not provide enough space for the development of critical thinking skills. As a result, students are rarely allowed to think deeply or question the information material. The lack of emphasis on understanding scientific concepts that are relevant to the surrounding reality also has an impact on the low quality of students' critical thinking. This is due to the lack of integration of socio-cultural environmental aspects in science education (Temuningsih et al., 2017). As a result, some students struggle to connect scientific concepts with practical applications in everyday life (Hamdani et al., 2019). Local wisdom in society can be a valuable source of inspiration to enhance the relevance of science learning, particularly when science learning is grounded in local wisdom by reinterpreting original scientific concepts and translating them into relevant scientific terms (Silla et al., 2023; Putra et al., 2023).

The importance of local wisdom in learning is also reinforced by the current phenomenon, where there is often a decline in students' interest and attention towards the use of culture in their environment (Annisha, 2024). Cultural integration in the learning curriculum is essential. This is expected to help foster a love for local wisdom in students (Silla et al., 2023). The Situbondo area is a coastal region that produces an abundance of marine resources, particularly fish (Hasanah, 2019). The local community processes some of the results of this wealth into petis. In the process of making petis, specific procedures require knowledge of the natural sciences. Through this learning, students not only learn the practical process of making petis but also gain an understanding of scientific concepts related to local wisdom (Rahman et al., 2023). The integration of petis with science learning not only enriches students' knowledge but also appreciates and utilizes the cultural heritage and local wisdom that exist within the Situbondo community as a whole.

The local wisdom-based learning approach would be more supportive if elaborated upon using the discovery learning model, where learners are allowed to discover and understand new concepts through direct experiences in everyday life (Rahman et al., 2021). Discovery learning emphasizes student-centered learning where the teacher only acts as a facilitator and students play an active role in finding information (Ambarwati & Sudibyo, 2019). According to Dari and Ahmad (2020), implementing the discovery learning model enables students to independently search for and identify concepts within the subject matter, making the material easier for them to understand and remember. This approach not only promotes conceptual understanding but also fosters critical thinking, creativity, and cultural awareness—essential components of 21st-century learning (Thornhill-Miller et al., 2023). Therefore, in this study the author conducted research on "Implementation of Discovery Learning Model Based on Local Wisdom to Improve Students' Critical Thinking Skills" with three purpose of the research: describe the enhancement of students' critical thinking results with the application of the local wisdom-based discovery learning model, describe the implementation of the local wisdom-based discovery learning model learning process to improve students' critical thinking skills, describe students' responses to the application of the local wisdom-based discovery learning model to improve students' critical thinking skills.

METHOD

This study employs a quantitative research approach, utilizing an experimental method, which is selected because it enables researchers to objectively and systematically measure the impact of a particular treatment—in this case, the application of local wisdom-based discovery learning—on students' critical thinking skills. Quantitative research is suitable for this purpose as it relies on numerical data, statistical procedures, and measurable outcomes, which are essential for evaluating the development of students' higher-order thinking abilities (Sugiyono, 2017; Arikunto, 2019). This study specifically aims to determine whether there is a statistically significant improvement in students' critical thinking skills before and after the treatment.

The type of research employed in this study is experimental. The experiment used is a pre-experimental design. Pre-experimental design is a design that involves only one group or class, which is given pre- and post-tests (Campbell & Stanley, 1963). The research design employed is a one-group pretest-posttest design. This research design is measured using a pre-test conducted before treatment and a post-test conducted after treatment. From these activities, the researcher aims to determine whether the discovery learning model has an impact on improving students' critical thinking skills. This study was conducted by MTs Negeri 2 Situbondo in the Even Semester of the 2024/2025 Academic Year with 25 students in the Grade 8-A as research subjects. The subjects of this study were selected through a non-probability sampling technique known as purposive sampling, which involves selecting data sources with specific considerations and tailoring them to meet the research needs (Campbell & Stanley, 1963).

The research instruments used included observation sheets for the implementation of learning, critical thinking skills test sheets, and student response questionnaires. The data collection techniques for this study include pre-test and post-test to collect data on aspects of knowledge which are then analyzed to obtain data on improving students' critical thinking skills, observation methods are used to observe the implementation of the discovery learning model based on local wisdom when learning takes place which includes preliminary, core and closing activities, then the questionnaire method to explore student responses after the implementation of the discovery learning model based on local wisdom which is filled in by students individually after participating in the learning process activities. The N-Gain value (g) is interpreted according to the categories of Hake (1998) as follows:

Table 1. N-Gain Categories

N-Gain	Improvement Category
$0,7 \leq \langle g \rangle \leq 1$	Tall
$0,3 \leq \langle g \rangle < 0,7$	Currently
$0 < \langle g \rangle < 0,3$	Low

Analysis of the implementation of the learning process quantitatively by calculating the value of each aspect based on the criteria for the implementation of the learning process from each meeting conducted using the Likert scale as follows:

Table 2. Criteria for the Implementation of learning

Score	Interpretation
1	Not Good
2	Quite
3	Good
4	Very Good

The average value results are then converted into learning implementation criteria scores. The learning implementation assessment criteria are as follows:

Table 3. Criteria for assessing the implementation of learning

Persentase (%)	Average score criteria
1 – 20	Not Good
21 – 40	Less Good
41 – 60	Quite Good
61 – 80	Good
81 – 100	Very Good

Analysis of the results of student responses to the application of the local wisdom-based discovery learning model is categorized using the Guttman scale of "yes or no," as follows:

Table 4. Guttman Score Criteria

Answer Options	Criteria
Yes	1
No	0

(Riduwan, 2012)

Table 5. Student Response Criteria

Persentase (%)	Criteria
1 – 20	Very Poor
21 – 40	Poor
41 – 60	Enough
61 – 80	Good
81 – 100	Very Good

(Riduwan, 2012)

RESULTS AND DISCUSSION

The research at MTs Negeri 2 Situbondo that has been carried out, obtained data including: (1) data on the results of improving students' critical thinking skills; (2) data on the analysis of the

implementation of learning; (3) data on student response questionnaires with the application of the discovery learning model based on local wisdom. Students' critical thinking skills were obtained based on pre-test and post-test scores. This learning outcome analysis utilizes N-Gain to measure the magnitude of the increase in pre-test and post-test scores. Based on the research conducted, students' critical thinking skills were measured and are presented in Table 6.

Table 6. Critical Thinking Skills Results of Students

Description	Pre-test	Post-test
Minimum Value	20	65
Maximum Value	60	95
Average	37,6	83,0

Based on Table 6, the average increase in pre-test and post-test scores is described. The increase in students' critical thinking skill scores was also analyzed using N-Gain. The data from the students' N-Gain test results are presented in Table 7.

Table 7. Results of the Student N-Gain Test

N-Gain Range	Category	Number of Students	Percentage (%)
$0,7 \leq \langle g \rangle$	High	15	60
$0,3 \leq \langle g \rangle < 0,7$	Medium	10	40
$\langle g \rangle < 0,3$	Low	0	0
Average N-Gain		0,73 (high)	

Based on Table 7, which describes an average N-Gain of 0.73 in the high category, this indicates that students' critical thinking skills have increased after the implementation of the local wisdom-based discovery learning model. The implementation of the local wisdom-based discovery learning model enhances learning outcomes, particularly students' critical thinking skills (Annisa et al., 2024). This study also aligns with As'adah and Setiawan (2024), who demonstrate that the implementation of the discovery learning model fosters students' critical thinking skills. The implementation of the learning process in this study was observed based on the application of the syntax of the local wisdom-based discovery learning model. This learning process was implemented over two meetings. At the first meeting, the material taught was the concept of separating mixtures using the filtration method. The second topic was the factors that influence the effectiveness of the filtration method. The first and second meetings are depicted in Figure 1.

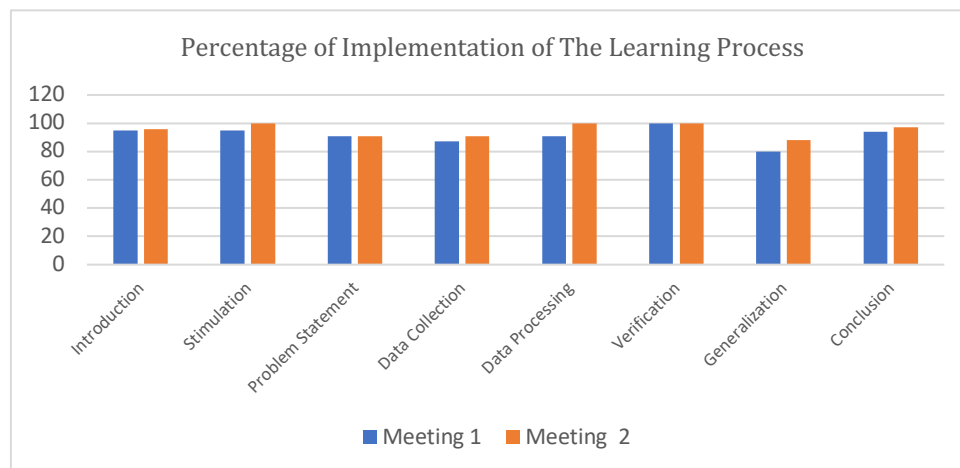


Figure 1. Percentage of implementation of the learning process

According to Figure 1, the application of the learning process using the discovery learning model based on local wisdom yielded percentage results of 91.62% at the first meeting and 95.37% at the second meeting, both in the very good category. The results of student responses were derived from the response questionnaire sheet consisting of 15 statement items. Students filled out the questionnaire sheet after the learning process, which consisted of two meetings using the local wisdom-based discovery learning model, was completed. The results of student responses are presented in Figure 2.

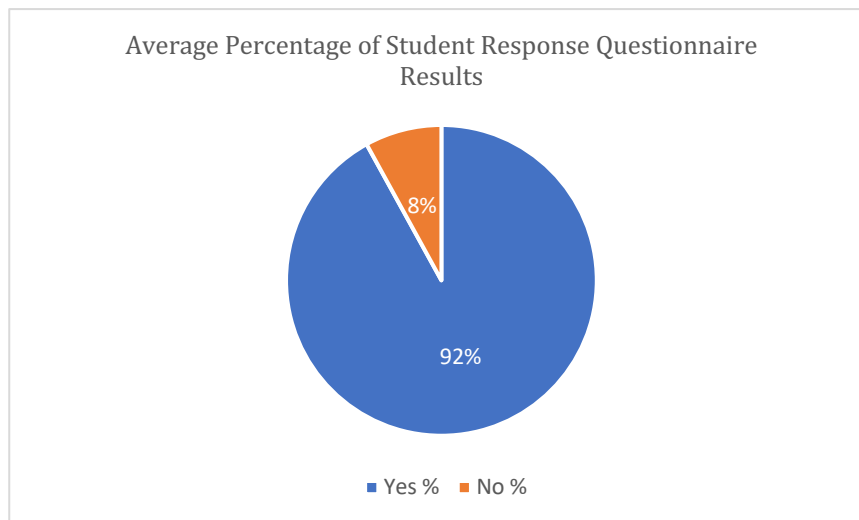


Figure 2. Average Percentage of Student Response Questionnaire Results

Based on Figure 2, the overall results of the statements submitted received a positive response, with an average answer of "Yes" at 92%. This indicates that the discovery learning model, based on local wisdom, to improve students' critical thinking skills, yielded a very positive response. Based on the results, the learning activities conducted over two meetings support this, as they align with the local wisdom-based discovery learning model, specifically the process of making *petis*, which serves as a learning context for the material on the separation of mixtures using the filtration method. The process of making *petis*, a regional specialty product that utilizes filtering techniques in its manufacturing stage. In this process, the fish is boiled to produce a liquid called *kelang*, which is derived from fish water. To obtain precise and high-quality shrimp paste, a filtration process is carried out to separate fish bones and other impurities from the boiled liquid. The filtering techniques used in making shrimp paste vary, such as the use of filter cloth or a sieve with small pores, each of which gives different filtration results. Learning approaches that integrate local wisdom can strengthen students' identity and foster a sense of pride in their culture and traditions (Santoso et al., 2022). Combining local cultural values and traditions in learning can make students more engaged with the material being studied and realize that the learning has direct relevance to their lives (Maharani & Muhtar, 2022). In addition, local wisdom-based learning can help students understand abstract science concepts more easily, because they get learning experiences that are directly related to real phenomena around them (Rahmawati & Santoso, 2023).

The learning process in the local wisdom-based learning model begins with stimulating students using local culture or wisdom that they frequently encounter. At the first meeting, the teacher provided a literacy study on the process of making *petis*. Students were asked to analyze the concept of separating mixtures contained in the process of making *petis*. Second, the teacher presented a simulation in the form of a literature study on the use of different filter media during the process of

making petis. Students were asked to analyze the effectiveness of two filter media on the filtration results. The teacher's stimulating activities have sparked students' enthusiasm for learning, as evidenced by the percentage of the learning process implementation score from all meetings, which consistently shows a figure above 90, indicating very good criteria. Local wisdom learning is highly effective in overcoming low learning interest because it is closely tied to students' daily lives, encouraging student enthusiasm and fostering high curiosity (Annisa et al., 2024). In line with Sukiastini et al. (2024) local wisdom in science learning can also enhance students' understanding, as this approach makes the material more relevant and contextual, making it easier for them to grasp the scientific concepts taught.

Positive responses from students indicate that local wisdom-based discovery learning makes the learning atmosphere more enjoyable and motivates students, as evidenced by the results of increased critical thinking skills and the effective implementation of the learning process. The results of this response are in line with Sasingan and Wote (2022), which states that the application of the Discovery Learning learning model received positive responses and was well-received by students. Science learning, when implemented using a local wisdom-based discovery learning model, helps students understand the material more easily (Masihu & Augustyn, 2021), particularly in the context of separating mixtures. A new learning experience is achieved through the integration of science with local wisdom culture in Situbondo, specifically the making of petis, which makes the material on separating mixtures more engaging and helps improve students' critical thinking skills. Learning that integrates local culture has a positive impact on students (Maharani & Muhtar, 2022), as they gain new experiences that serve as a means of instilling a sense of appreciation for local wisdom in their area (Santoso et al., 2022). In addition, this approach helps students connect learning concepts with everyday life that is close to them (Ningtyas & Setiawan, 2023), making the material on separating mixtures easier to understand and more enjoyable to learn.

CONCLUSION

Based on the analysis of research data, the application of local wisdom-based discovery learning significantly enhances students' critical thinking skills. This is reflected in their increased analytical abilities, active participation, and positive responses to the applied methods. The main findings revealed that students were more effective in identifying problems, formulating hypotheses, analyzing data from experiments, and drawing logical conclusions. They also demonstrated improved collaboration and communication during group activities. This study contributes to educational science by demonstrating that integrating local wisdom into discovery learning is an effective way to improve learning quality, particularly in fostering critical thinking skills. It also serves as a valuable reference for educators in designing more contextual and meaningful learning experiences. However, the research had limitations, especially related to the availability of laboratory equipment and facilities, which may have influenced the implementation quality. Future studies are recommended to address this issue by ensuring the availability of adequate tools.

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