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Implementing Nearpod-assisted Inquiry Based Learning on Students' Critical Thingking Skills at Fluids Topic

Finurikha Fina Udiana*, Joko Budi Poernomo, Edi Daenuri Anwar

Physics Education, Walisongo State Islamic University Semarang, Indonesia

*****Correspondence to: *finnafinuu@gmail.com*

Abstract: Research on Implementing Nearpod-assisted Inquiry Based Learning on Students' Critical Thingking Skills at Fluids Topic. This research was conducted at SMA Negeri 3 Demak using a quantitative approach and quasi-experimental design , namely pretest posttest control group design. Data analysis techniques used homogeneity test, normality test, n-gain test, t-test, and Likert scale test. There is a difference in students' critical thinking skills between the experimental and control classes using the Nearpod -assisted Inquiry Based Learning model . Data analysis shows that the increase in critical thinking skills in the experimental class is in the high category, while in the control class it is in the medium category. Student responses to the implementation of the Nearpod-assisted Inquiry Based Learning model are in the very positive category. This is indicated by the percentage of responses of 77% in the strongly agree category and 22% in the agree category.

Keywords: Inquiry based learning; Nearpod, Critical thinking skills; Static fluid; Student responses

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Introduction

Critical thinking reflects the ability and attitude to objectively assess beliefs. This assessment involves identifying the underlying assumptions of a thought. Improving the quality of learning emphasizes the importance of developing higher-order thinking skills in students. These skills include critical thinking, creative thinking, problem-solving, and decision-making. These competencies encompassing communication, collaboration, critical thinking, problem-solving, creativity, and innovation (Ni'mah et al., 2021). Learning aims to influence and stimulate internal processes within students, such as attention, perception, reasoning, and understanding, ultimately leading to behavioral change and increased competence. Learning must be designed not only based on the substance of the material but also considering pedagogical approaches, effective learning strategies, and a learning environment that optimally supports student engagement and active participation (Muna, 2021) . *The Inquiry-Based* Learning model places students at the center of learning activities (Listiantomo & Dwikoranto, 2023). The use of appropriate media encourages the creation of a more effective, participatory, and meaningful learning process for students (Wulandari et al., 2023) .

Interviews with subject teachers at SMA Negeri 3 Demak revealed low student participation in the learning process. Student activity in data collection and calculations during practicums did not reflect optimal engagement. The learning methods used were still monotonous. Available teaching materials were not able to maximize student competency achievement. Teachers stated that students were not adequately facilitated in developing critical thinking skills during learning activities. Teachers suggested implementing learning models that could encourage student activeness in investigating and analyzing data.

Inquiry Based Learning is seen as an appropriate approach because it provides space for students to explore problems relevant to the learning material. Interactive technology-based learning media such as Nearpod are considered to increase participation and facilitate the investigation process. Teachers believe that this strategy can help improve students' critical thinking skills more effectively. The research objectives to be achieved in this study are as follows: To differentiate students' critical thinking between the control

class and the experimental class using the Inquiry Based Learning model assisted by Nearpod and to find out students' perceptions of the use of the Inquiry Based Learning model assisted by Nearpod.

The Inquiry-Based Learning model encourages students to ask questions and draw conclusions based on general principles through experience and practical activities (Sanjaya, 2016). The term "critical thinking" was coined by American philosopher John Dewey (1910). However, Dewey more often referred to it as reflective thinking. Dewey defined it as the active, ongoing, careful consideration of a form of belief or knowledge assumed based on supporting reasons and other conclusions (Rahardhian, 2022).

Learning media are tools or aids used in the teaching and learning process, which aim to convey information or learning messages from sources, such as teachers or other sources, to students (Muryanto, 2014) . *Nearpod* is a learning space *platform* that enables unique interactions between students and teachers. When meeting in a virtual space, teachers can create and play together presentations that include images, text, videos, and even quizzes (Rosidah, 2022). Fluids are defined as substances that can undergo continuous changes in shape when subjected to pressure or shear forces, even if the force is relatively small. The First Law of Hydrostatics states that all points on the same plane in a homogeneous fluid experience the same total pressure. Therefore, even if the cross-sectional shape of the tube is different, the total pressure remains the same. Students often lack precision in their calculations, so critical thinking is essential to obtain accurate results (Giancoli, 2014).

Previous research relevant to the study on the effect of using the Discovery Learning model on the critical thinking skills of fourth-grade students on Theme 1 at MI Al-Islam Gunungpati Semarang. The research results show that the discovery learning model of instruction has a significant effect on the critical thinking skills of fourth-grade students at MI Al-Isla Gunungpati Semarang. The similarity of this study is to determine students' critical thinking skills. The difference lies in the learning model (Anjelly, 2022). This study aims to analyze the implementation of a guided inquiry model assisted by a virtual lab to analyze the results of improving critical thinking skills in 11th-grade students after implementing a guided inquiry model assisted by a virtual lab on the topic of light waves. The similarity of this study is to determine students' critical thinking skills using the inquiry learning model. The difference is that it uses different learning media (Listiantomo & Dwikoranto, 2023).

Methods

This research was conducted at SMA Negeri 3 Demak, located at Jl. Sultan Trenggono No. 81, Kalikondang, Demak District, Demak Regency, Central Java. Data collection was conducted during the even semester of the 2024/2025 academic year, specifically from April 24 to May 30, 2025. The population of this study involved students in grade XI at SMA Negeri 3 Demak in the 2024/2025 academic year. The students were divided into four classes, namely XI MIPA 4, XI MIPA 5, XI MIPA 6, and XI MIPA 7. The total number of students was 144.

This study adopted a quasi-experimental approach by applying two types of designs, namely pretest posttest one group design and pretest posttest control group design. The researcher compared student learning outcomes in one group by measuring the difference between pretest (before treatment) and posttest (after treatment) scores. The experimental class, namely the class given treatment using the Inquiry Based Learning model using interactive learning media based on Nearpod, while for the control class, namely the class given treatment using the conventional learning model using lecture and discussion methods. using the same learning media. Using random sampling techniques to take samples from the population of class XI. The control class is in class XI-7 and the experimental class is in class XI-4.

The data collection technique used in this research is a written test. The *pretest* was conducted before students were given the learning model and learning media application, while the written *posttest* with descriptive questions was conducted after students were given the learning model and used the learning media application. Documentation is a data collection technique that involves scanning and analyzing documents, photos of activities, recaps of grades and research instruments.

Trial analysis using validity tests examines the accuracy or precision of an instrument in making measurements. Reliability tests measure how reliable or dependable a measuring instrument is. Discriminatory power tests are numerical values that indicate the difference between the top and bottom groups. Difficulty tests indicate students' level of difficulty.

Data analysis techniques using the homogeneity test are used to determine whether the control and experimental groups are similar or not. The normality test is a test used to determine whether this research sample comes from a normal population or not. The N-Gain Test compares the results of the concept understanding improvement test, namely student results after *the pretest* and *post-test.* The t-test is used to compare the average critical thinking skills between the control and experimental classes.

Results and Discussion

Instrument Testing Result

Validity is the accuracy or precision of an instrument in making measurements. Testing data collection instruments, validity is divided into factor validity and item validity. Find the value of the correlation coefficient compared to the results in the product moment table with a 5% significance level. An item is considered valid if $r_{count'} > r_{table}$. The data results obtained show that out of 15 items, 10 items were valid and 5 items were invalid. Invalid items were discarded or not used as pretest and posttest questions. The questions used in the pretest and posttest were 10 valid questions.

Reliability tests are used to determine how accurate or consistent the answers to the test instrument are. If $r_{count'} > r_{table}$ then the test items are The reliability test was tested. The results of the reliability test calculation, the $r_{count'}$ results obtained a value of 0.70 which means that the test instrument from the trial results was reliable using 15 *Essay test questions.*

The level of difficulty is to determine whether the questions are difficult, medium, or easy. The calculation of the item difficulty index revealed no items with either difficult or easy criteria. All 15 questions had a moderate difficulty index.

Discriminatory power is the ability of a question to differentiate between low-ability students and high-ability students. The results of the discriminatory power test of 15 items showed that 4 items had good criteria, 8 items had sufficient criteria, and 3 items had poor criteria.

Descriptive Statistics

A normality test is performed to determine whether the data to be used is normally distributed or not. The data used for this final normality test are the pretest and posttest. The normality limits are based on the significance level in the graph. Data is considered normally distributed when the significance level exceeds 0.05 (p). > 0.05). However, if the significance value is lower than 0.05 (p < 0.05).

Table 1. Tests of Normality

	Class	Kolmogorov-Smirnov [a]			Shapiro-Wilk		
		Statistics	df	Sig.	Statistics	df	Sig.
Learning outcomes	Control Class Posttest	.160	36	.021	.943	36	.063
	Experimental Class Posttest	.104	36	.200 *	.947	36	.087

The normality test for pretest data in both classes showed a significant value greater than 0.05. Based on these results, it was concluded that the data for both classes were normally distributed. The normality test for posttest data in both classes showed a significant value greater than 0.05. The calculation results showed that the control class obtained a significant value of 0.063, while the experimental class obtained a significant value of 0.087. Based on these results, it was concluded that the data for both classes were normally distributed.

A homogeneity of variance test was conducted to determine whether the four data groups had the same variance. The calculation results showed that the pretest obtained a significance value of 0.937, while the posttest obtained a significance value of 0.263. Based on these results, it can be concluded that both data are homogeneously distributed.

The N-gain test aims to compare the results of the critical thinking skills improvement test, namely the results of students after the Pretest and post-test. The average N-gain value of control class students is 0.4572, which is included in the medium category with the criteria of $0.3 \leq g \geq 0.7$ and the average N-gain value of the experimental class is 0.7008, which is included in the high category with the criteria of $g > 0.7$.

The *t-test* aims to determine whether there is a difference in the average critical thinking skills between the experimental and control classes. The test results are considered to have a difference if the Sig. value (2-tailed) <0.05. If the Sig. value (two-tailed) is >0.05, it means there is no significant difference between the means of the two paired data groups.

Likert scale analysis was used to determine students' responses to the *Nearpod*- assisted *Inquiry Based Learning model* in Fluid Material Learning on Students' Critical Thinking. The Likert scale results showed that the percentage of student responses was 77% strongly agree, 22% agree, and 1% disagree.

Table 2. N-gain Test Results Pretest Posttest

Class	Average value	Category
Control	0.46	Low
Experiment	0.70	High

The N-gain test results were used to measure the improvement of students' critical thinking skills before and after treatment. The N-gain score of the experimental class showed an average value of 0.7008, a high improvement category. The control class showed an average value of 0.4572, a moderate improvement category. The difference in N-gain values between the two groups indicated a significant effect of the treatment given. The experimental class experienced a higher improvement than the control class. The application of the Inquiry Based Learning model assisted by Nearpod made a significant contribution to improving students' critical thinking skills. The increase in N-gain values in the high category reflects the effectiveness of the inquiry-based learning model with the support of Nearpod interactive media. The improvement not only occurred quantitatively, but also reflected an increase in the quality of students' thinking. The experimental class showed better ability in solving problems that measure critical thinking indicators. Improvements occurred in the aspects of formulating questions, constructing arguments, drawing conclusions, and determining actions (Ennis, 1995).

The t-test results show a significance value of 0.000. The value is smaller than 0.05. There is a significant difference between the experimental class and the control class. The calculated t-value is greater than the t-table. The null hypothesis is rejected. The alternative hypothesis is accepted. There is a difference in students' critical thinking skills between the experimental class and the control class. The results of the analysis prove that the Nearpod-assisted Inquiry Based Learning model is effective in improving students' critical thinking skills on static fluid material. Improved critical thinking skills in the experimental class are obtained through meaningful learning experiences. The Inquiry Based Learning model requires active student participation.

Nearpod media supports engagement through interactive activities such as quizzes, discussions, simulations, and hands-on assessments. Students build understanding through the process of investigating, analyzing data, and drawing their own conclusions. These activities encourage students to use reasoning, consider evidence, and evaluate existing arguments (Listiantomo & Dwikoranto, 2023).

The use of conventional learning models in the control class did not provide a comparable learning experience. The learning process was passive. Students simply received information without exploring. Thinking activities were limited to memorization and repetition. Critical thinking skills did not develop optimally. Posttest results showed improvement, but not as significant as in the experimental class.

Research Results Research shows that inquiry-based learning is effective in improving students' cognitive learning outcomes. The learning process actively engages students. The use of learning technologies such as Nearpod increases learning efficiency and appeal. Interactive applications enhance students' analytical and critical thinking processes. Differences in learning outcomes between the two groups indicate that learning models and learning media are the primary determinants of critical thinking skills improvement (Susanto, 2021).

This research reinforces previous findings showing that inquiry-based learning is effective in developing higher-order thinking skills. This model provides students with opportunities to practice formulating hypotheses, testing assumptions, and verifying results through data. Students experience an active learning process. Interaction with the material occurs through investigation and reflection. This process develops scientific sensitivity and reflective thinking skills (Nurmayani et al., 2018).

Nearpod, as a supporting medium, offers flexibility and interactivity. Visual, audio, and evaluation features enrich the learning experience. Learning activities become more engaging and less monotonous. Students can access materials individually or collaboratively. A direct feedback system allows students to assess their level of understanding in real time. Teachers can evaluate learning outcomes effectively. The learning process is dynamic (Ikbal, 2022).

The effectiveness of the inquiry-based learning model with the help of Nearpod is not only reflected in the final score. Its effectiveness is evident in student engagement, enthusiasm during the lesson, and the quality of the arguments presented when answering questions. The implementation of this model results in overall improvements in students' cognitive aspects. Learning becomes a means of developing more complex and in-depth thinking skills.

These results demonstrate that learning is not simply about conveying information. Learning must shape mindsets. Students need to be trained to analyze information, critique opinions, and make decisions based on data and evidence. The Inquiry-Based Learning model provides the space for this. Nearpod, as a medium, supports today's technology-based and interactive learning needs.

The test results show that the Nearpod-assisted Inquiry Based Learning model has a significant effect on improving students' critical thinking skills. The difference in pretest and posttest results in the experimental class indicates the effectiveness of the treatment. The N-gain test strengthens these findings. The t-test results provide valid statistical evidence of a significant difference between the two groups. All analysis results support the alternative hypothesis. The Nearpod-assisted Inquiry Based Learning model is effective in improving students' critical thinking skills in static fluid material.

Table 3. Likert Scale Results

f	Percentage of Student Response Results (%)	Category
413	77	Strongly agree
120	22	Agree
6	1	Don't agree
0	0	Strongly disagree

A Likert scale questionnaire data analysis was conducted to reveal students' responses to the implementation of the Nearpod-assisted Inquiry Based Learning model in fluid material learning. The analysis results indicated that of the total 539 student responses, 413 responses (77%) stated that they strongly agreed, 120 responses (22%) stated that they agreed, and only 6 responses (1%) stated that they disagreed. No students responded that they strongly disagreed. These data indicate that the majority of students responded positively to the implementation of the model.

The frequency distribution of student responses demonstrates high acceptance of the learning strategy used. The high percentage of "strongly agree" respondents reflects the model's success in meeting student expectations regarding the learning process. This high level of acceptance indicates that Nearpod-

assisted Inquiry-Based Learning is highly appealing to students in the physics learning process, particularly fluids.

The Inquiry-Based Learning model directs students to actively construct knowledge through the process of scientific investigation. Students gain experience in formulating problems, forming hypotheses, collecting data, testing evidence, and drawing conclusions. This process reflects the construction of knowledge that stems from active student involvement. Such activities enable students to shape the meaning of learning through experience, thereby enhancing their understanding and interest in the material. The "strongly agree" category dominated all aspects of the questionnaire. Statements responded positively included: active student involvement during learning, clarity of material through the interactive Nearpod media, and ease of understanding fluid concepts with the support of visualizations and simulations. This confirms that the use of Nearpod media contributes to increasing student engagement and understanding of the material. The Inquiry-Based Learning model systematically organizes learning activities. The process begins with problem orientation, hypothesis formulation, exploration, testing, and conclusions. Each stage provides students with space for critical, logical, and creative thinking. This structure encourages students to develop analytical skills through observation and investigation. These activities demonstrate the strong relevance between learning and skills, particularly critical thinking and problem-solving.

The implementation of technology-based learning media such as Nearpod is an appropriate strategy for optimizing the Inquiry-Based Learning model. Digital media provides flexibility in material delivery, high interactivity, and comprehensive student engagement. Ikbal (2022) stated that learning media can help students understand complex material visually and practically. This learning model places students at the center of learning activities. Students learn to discover scientific concepts for themselves through investigation and exploration. This allows them to optimally develop critical thinking skills. Activities such as observation, experimentation, and drawing conclusions based on evidence foster a strong scientific attitude and intellectual responsibility in students.

The implementation of the Inquiry-Based Learning model, supported by Nearpod, optimizes the use of learning time to be more effective and productive. Teachers act as facilitators, guiding students' learning process. Students become the primary actors in exploring and developing knowledge. This learning system not only delivers material but also creates meaningful learning experiences that have a long-term impact on conceptual understanding and cognitive skills. The Inquiry-Based Learning model encourages students to think critically, independently, and reflectively. The investigation and testing activities in learning foster analytical and systematic thinking patterns. Students are trained to ask questions, analyze data, and draw logical, evidence-based conclusions. These skills are essential for facing the challenges of learning and real life. Student engagement during learning fosters self-confidence and collaborative skills. Students learn to respect others' opinions, express ideas appropriately, and solve problems collaboratively. Learning becomes more meaningful because students are emotionally and intellectually engaged.

Conclusion

Based on the description of the results and previous discussion, it can be concluded that: There is a difference in students' critical thinking skills between the experimental class and the control class using the Inquiry Based Learning model assisted by Nearpod. The results of the posttest t-test provide a significance value below 0.05, which means there is a significant difference between the means of the two paired data groups. This significance value indicates that the applied learning model has a significant effect on improving students' critical thinking skills.

The implementation of the Nearpod-assisted Inquiry Based Learning model has made a positive contribution to student learning outcomes, particularly in developing critical thinking skills. Student responses to the Nearpod-assisted Inquiry Based Learning model were very positive. This is indicated by the percentage of responses of 77% in the strongly agree category and 22% in the agree category. The number of students who disagreed was very small, at only 1%, while there were no responses in the strongly disagree category.

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