Transforming Learning Experiences: Student Perspectives on Differentiated Learning in Guided Inquiry

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Article Info	ABSTRACT
	The enhancement of critical thinking abilities and student involvement can be achieved through the use of differentiated learning and guided inquiry. With the use of questionnaires, this study intends to assess students' critical thinking abilities and provide an explanation of varied learning in guided inquiry. The research design was a one-group pretest-posttest. The paired t-test and n-gain were used to assess the test findings. The paired t-test of less than 0.001 it can be concluded that there is a significant difference between the two tests that have been conducted and the normalize-gain (n-gain) of 0.8 with strong improvement requirements both demonstrated an improvement in the critical thinking abilities of the pupils. The learning process using a differentiated learning model in guided inquiry learning was also responded very well by students with 63% of statements mode 4 with the category strongly agree and 57% of statements mode 3 with the category agree. Based on this, it can be concluded that the majority of students felt the benefits and convenience in following the learning process applied, as well as feeling more challenged and motivated to develop their critical thinking skills. With the results obtained from this study, it is expected that the differentiated learning approach in guided inquiry can be implemented more widely to improve the quality of education and students' critical thinking skills.

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1. Introduction

In the current era of progress, science and technology have become an integral and inseparable part of people's lives (Fadli, 2021). This condition requires

education in the 21st century to prepare individuals with thinking skills and mastery of technology in order to compete in the global arena (Ananda & Fauziah, 2022). One of the skills that must be mastered is learning and innovation skills, especially 4C skills, which include four aspects, one of which is critical thinking skills (Wahyuddin et al., 2022). Critical thinking skills are essential basic abilities in problem solving (Lee et al., 2024). This skill is very important for students to identify the source of the problem and find the right solution (Erlistiani et al., 2020). Critical thinking has been recognized as a key skill for achieving success in life, work and learning in the 21st century (Budiyanto et al., 2024).

In line with these skills, the results of the 2022 PISA test organized by the OECD, which is a reference for assessing the quality of education globally, show that Indonesia is still in a low position (Sukmawati & Ghofur, 2023). This is indicated by a decrease in the PISA 2022 reading score by 12 points to 359 from a score of 371 in 2018. The math's score also decreased by 13 points to 366 from 379 previously, and the science score decreased by 13 points to 383 from 396 previously (OECD, 2022). This achievement still does not meet the target of the National Medium-Term Development Plan (RPJMN) in 2024, which is a reading score of 392, a math's score of 388, and a science score of 402. The questions in PISA demand problem-solving skills and reasoning ability (Bahar et al., 2020). A student is considered to have the ability to reason if they can apply their knowledge to new situations that they have never faced before. This ability is often referred to as critical thinking skills (Ghifari et al., 2022).

The government has high expectations for the improvement of students' critical thinking skills in Indonesia. The government is improving the quality of education in Indonesia by improving the existing education curriculum, namely by developing a new curriculum known as the learning recovery curriculum or the independent curriculum (Nuryani et al., 2023). The Merdeka Curriculum is characterized by student-centered learning, namely with an inquiry-based approach (Kahar et al., 2021). Departing from this, based on research by Laili (2023) Science learning in schools today in fact still tends to be teacher-centered, so that students are not used to developing their potential. One of the student-centered learning models is guided inquiry learning (Mauk et al., 2022).

Although the guided inquiry learning model is effective in developing critical thinking skills, it cannot answer or be a solution to the diverse learning needs of students. This is because each student has different characteristics, backgrounds and abilities (Hanifah et al., 2020). The independent curriculum facilitates learning according to students' abilities, interests and needs, which is called differentiated learning (Kemendikbudristek, 2021). In fact, current learning at the same level or level, the learning process for each student tends to be uniformed with the assumption that all students have the same abilities and interests (Adisjam & Saparia, 2023).

This study is based on the premise that the implementation of differentiated learning in the context of guided inquiry can improve students' critical thinking skills in Indonesia. This research will explore the extent to which this model can be effectively implemented and its impact on the development of students' critical thinking skills. It is hoped that this research will provide new insights to develop more adaptive and effective learning strategies, which will contribute to improving

the quality of education in Indonesia. The proposed solution is the development of a new education curriculum that supports differentiated learning, particularly through the guided inquiry approach, which can accommodate students' individual differences. By implementing this solution, it is expected that there will be a significant improvement in students' critical thinking skills, which in turn will contribute to improving the overall quality of education in Indonesia.

2. Method

This study employs a quantitative descriptive research design. Pre-experimental research with a single group pretest and posttest design is the methodology employed; one experimental group receives treatment without the presence of a control group. The one group pretest-posttest design makes it possible to measure changes directly from the initial condition (before the intervention) to the final condition (after the intervention). The one group pretest-posttest design fits the needs of research in the education field in Indonesia which often requires evaluating existing educational practices and identifying changes or improvements that may occur after the implementation of a particular innovation or intervention. In this case, this research will make a real contribution to the understanding and development of learning practices in Indonesia, especially in improving the quality of education through the development of critical thinking skills.

The twenty students in class VIII A Junior High School Laboratory Unesa 2 — eleven males and nine females — were the study's target population. The scientific subject teacher recommends utilizing the purposive sample strategy to select the subjects since it is evident from the value and activity during the learning process.

The instruments used in this study include learning style questionnaires and essay questions on students' critical thinking skills on vibration material with a total of 5 questions with critical thinking indicators according to Ennis (2011) including: providing simple explanations, building basic skills, making conclusions, making further explanations, and making strategies and tactics. This questionnaire contains 15 statements of opinion from students regarding motivation, guided inquiry learning stages, and differentiated learning with a Likert rating scale.

The results of the critical thinking skills test were analyzed using the normality test to determine whether the data were normally distributed or not, paired t-test, and N-Gain to determine the improvement of students' skills. Analyze the results of improving critical thinking skills using N-gain. The scores of all students were then averaged and then compared between the pretest and posttest scores. To identify how the improvement is then calculated N-gain. N-gain can be calculated by the formula:

$$< g >= \frac{\% < Sf > - \% < Si >}{\% < Smaks > - \% < Si >}$$

(Hake, 1998)

Information:
<g>= N-Gain
<Sf>   = Final score (Posttest)
<Si>   = Initial score (Pretest)

In calculating n-gain can use the help of SPSS software or Microsoft Excel, the normalized gain criteria (N-gain) as follows.

Table 1. Categories of Critical Thinking Improvement Using N-Gain

N-Gain Value (g)	Category
g > 0,7	High
0,3 ≤ g ≤ 0,7	Medium
g < 0,3	Low

(Hake, 1998)

The questionnaire was conducted after the learning was over. Indicators used in this questionnaire include motivation, guided inquiry stages, and differentiated learning. Questionnaire data will be analyzed using mode. The student response questionnaire categories can be seen from table 2 below.

Table 2. Likert Scale Assessment Categories

Assessment	Category
Strongly Agree	4
Agree	3
Less Agree	2
Disagree	1

(Gunawan & Ramdhani, 2024)

3. Results and Discussion
Results

Students critical thinking skills were evaluated by giving pretest and posttest questions, each lasting 40 minutes. The results of the two tests were then analysed through Normality test, Paired T-test, and N-Gain analysis.

The normality test was conducted to determine whether the data followed a normal distribution. This analysis was conducted using SPSS software, and the results are presented in Table 3.

Table 3. Shapiro-Wilk Normality Test Results

	Statistic	Df	Sig
Pretest	0,936	20	0,204
Posttest	0,918	20	0,089

In this study, because the amount of data was less than 50, the Shapiro-Wilk Normality Test was applied. Based on Table 3, it is known that the normality test results for pretest and posttest data show a significance value of 0.204 and 0.089, respectively. A significance value greater than or equal to 0.05 indicates that the data is normally distributed. Therefore, based on the results of this normality test, it can be concluded that the data in this study are normally distributed.

After the normality test, the data was then tested using the paired sample t-test with the SPSS programme. This paired sample t-test was used to determine the improvement of students' critical thinking skills through Differentiated Learning in Guided Inquiry Learning. The results of the paired t-test conducted with the SPSS programme are presented in Table 4 below.

Table 4. Paired T-test Results

	Mean	t	df	Sig
Pretest-Posttest	-42.750	-20,681	19	<0,001

Based on Table 4, the paired t-test results show a significance value (Sig. 2-tailed) of less than 0.001. Since this value is smaller than 0.05, it can be concluded

that there is a significant difference between the two tests that have been conducted. These results support that the intervention or treatment given, namely the application of differentiated learning in guided inquiry, has a significant impact on the variables measured, namely students' critical thinking skills. This indicates that the applied learning approach or strategy is effective in improving students' critical thinking skills.

The improvement of critical thinking skills can also be seen through the N-Gain value of the pretest and posttest results, which are presented in Table 5 below.

Table 5. N-Gain Results of Pretest and Posttest

Student Code	Value		N-Gain	Category
	Pretest	Posttest		
S1	20	75	0,7	Medium
S2	60	90	0,8	High
S3	60	95	0,9	High
S4	50	90	0,8	High
S5	35	90	0,8	High
S6	35	75	0,6	Medium
S7	35	80	0,7	Medium
S8	25	90	0,9	High
S9	60	95	0,9	High
S10	50	80	0,6	Medium
S11	50	90	0,8	High
S12	65	95	0,9	High
S13	30	80	0,7	High
S14	35	85	0,8	High
S15	35	75	0,6	Medium
S16	50	85	0,7	Medium
S17	40	85	0,8	High
S18	40	85	0,8	High
S19	40	85	0,8	High
S20	35	80	0,7	Medium
Average	**42,5**	**85,25**	**0,8**	**High**

Based on Table 5, the pretest and posttest results show that the average N-Gain is 0,8, which is included in the high category. This shows that students' critical thinking skills have increased significantly. The percentage increase in pretest and posttest results of students in class VII-A is shown in Figure 1 below.
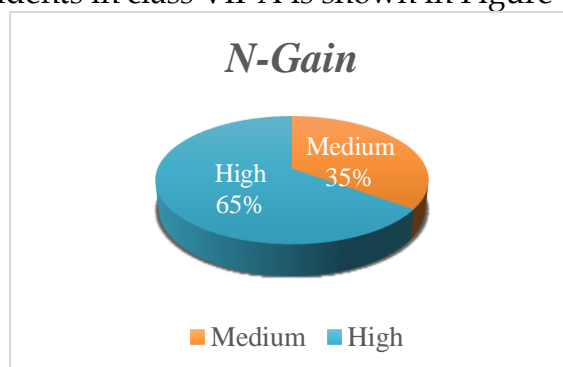

Figure 1. Diagram of Improved Critical Thinking Skills

Based on Figure 1, it is known that the increase in students' critical thinking skills is mostly in the high category, which is 65%. The remaining 35% were in the medium category. This shows that the application of differentiated learning in

Guided Inquiry Learning has resulted in a high increase in critical thinking skills in most students.

The following are the results of students' responses regarding the application of differentiated learning in Guided Inquiry Learning.

Table 6. Learners' Response to Learning

No.	Statement	Number of Respondents				Modus
		1	2	3	4	
Learning Motivation						
1.	The phenomenon presented attracts attention and is able to increase motivation to learn Vibration material.			8	12	
2.	The applied learning can improve co-operation between friends.			6	14	
3.	My active role in learning is increased when the teacher applies this learning.			11	9	4
4.	I am not confused if the Vibration material is delivered with differentiated learning in guided inquiry learning.			9	11	
5.	The lessons taught made me understand and remember the material better.			8	12	
Stages of Guided Inquiry Learning						
6.	The lessons taught improved my ability to identify and formulate problems.			6	14	
7.	The lessons taught can improve my ability to make provisional conjectures based on the formulation of the problem.			4	16	
8.	The lessons taught improved my ability to plan investigations.			5	15	
9.	My ability to collect data and carry out investigations has improved through this learning.			13	7	4
10.	My ability to analyse data to test hypotheses has improved through this learning.			6	14	
11.	My ability to formulate conclusions has improved through this learning..			5	15	
12.	My ability to communicate results has improved through this learning.			8	12	
Differentiated Learning						
13.	The learning process helps me understand the material better because it is tailored to my abilities, experiences and interests.			8	12	
14.	The variety of learning methods used is very interesting.			7	13	4
15.	The tasks given are in line with my abilities, experience and interests.			7	13	

Based on Table 6, the overall results of the responses show that the mode of student responses is 'strongly agree' (score 4), which is categorised as excellent. This is evident from the responses related to learning motivation, Guided Inquiry Learning stages, and differentiated learning, which all have a modus of 'strongly agree' (score 4). The responses show that the application of differentiated learning increases students' learning motivation towards vibration material. This shows that students feel encouraged and excited to learn when the material is delivered with an approach that is tailored to their abilities, experiences and interests.

There was an increase in students' ability to identify and formulate problems, make provisional hypotheses, plan investigations, collect data, analyze data to test hypotheses, formulate conclusions, and communicate results. This shows that guided inquiry learning is effective in developing various aspects of scientific skills and critical thinking.

Students feel that the learning process helps them understand the material better because it is tailored to their abilities, experiences and interests. The variety of learning methods used is also considered very interesting, and the assignments given are in line with students' abilities, experiences and interests.

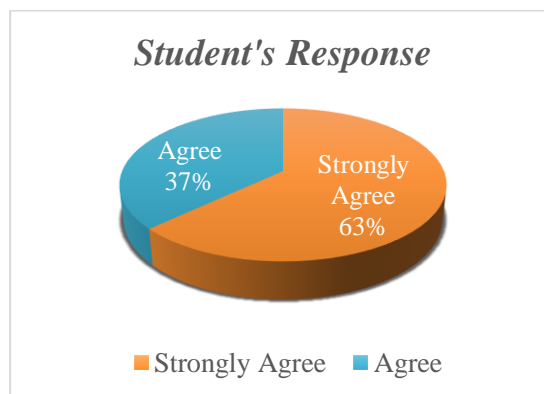The percentage distribution of student responses in class VIII-A is shown in Figure 2 below.

Figure 2. Student Response Percentage Diagram

Based on Figure 2, it is known that most student responses are in the strongly agree category, which is 63%. The remaining 37% were in the agree category. This shows that the application of differentiated learning in Guided Inquiry Learning has been well received by students.

Discussion

It is evident from the data from the pretest and posttest findings that students' critical thinking abilities have improved. This is evident from the high category's average n-gain findings, which are 0.8. The paired t-test results, which display a significance value (Sig. 2-tailed) of less than 0.001, further corroborate this. Since this value is smaller than 0.05, it can be concluded that there is a significant difference between the two tests that have been conducted. This can happen because of the excellent student response after the implementation of differentiated learning in guided inquiry. The following is an explanation of each statement from the student response results.

In statements related to learning motivation, there are five statements with three modes of answer strongly agree, and one two modes of answer agree. The agree answer mode related to the level of learner activeness is a discussion point. This can occur when learning takes place, such as during question and answer discussions, some students are active and others feel less confident. This is in line with the statement put forward by Vygotsky (1978), that social interaction plays a fundamental role in cognitive development. Vygotsky emphasised the importance of the 'zone of proximal development,' where students can reach higher levels of understanding with help from more competent people. The lack of active participation of most students could be due to their lack of confidence to interact

within this zone without adequate support. This statement is also supported by Bandura (1986) theory of social learning, which highlights the importance of self-efficacy or self-belief in one's ability to perform a particular task. Bandura argues that students with low self-efficacy tend to avoid active participation due to fear of failure or negative judgement from peers.

There are seven statements related to the stages of guided inquiry learning, with three strongly agreeing and two agreeing. In the statement of improving the ability to identify and formulate problems is discussed because in their daily lives students are still not accustomed to carrying out the inquiry process so they still need teacher guidance so that learning activities are in accordance with plans, objectives, and learning outcomes. This is supported by the opinion expressed by Banchi & Bell (2008) regarding guided inquiry. Banchi & Bell identify several levels of inquiry, including guided inquiry, in which the teacher provides questions or problems to students, but students must design their own procedures and methods to find the answers. In this stage, guidance from the teacher is essential as students still need help in formulating good questions and choosing appropriate methods for their investigations (Sarnoto, 2024). Through teacher guidance in the guided inquiry process, students can develop better critical thinking and problem-solving skills. The teacher acts as a facilitator who provides support, feedback and guidance during the learning process (Pawartani & Suciptaningsih, 2024). In this way, students can gradually improve their ability to conduct inquiry independently.

There are three statements related to the stages of Differentiated Learning, with the answer mode strongly agreeing. This happens because when learning, students feel challenged and interested because of learning innovations that are tailored to their own interests and experiences. This is in line with the statement that differentiated learning provides a more meaningful experience for students because it takes into account individual needs and links learning materials with relevant contexts in students' lives (Latifah, 2023). This is also supported by Tomlinson (2001) when students feel that learning takes into account their needs and interests and is related to their lives, they tend to be more engaged in learning and have higher intrinsic motivation to learn.

Based on students' excellent responses to statements related to learning motivation, guided inquiry learning stages, and differentiated learning, it supports the improvement of critical thinking skills. When students feel engaged and motivated in learning, especially through guided inquiry learning model that encourages them to actively question, investigate, and think critically, they tend to develop critical thinking skills naturally.

Differentiated learning also plays an important role in improving students' critical thinking skills as it allows for a customised approach to students' individual needs and interests. When students get learning materials that are relevant to their life experiences and their interests, they are more likely to be actively involved in the learning process and use critical thinking skills to understand, analyse and evaluate information.

With the combination of guided inquiry learning model that encourages active exploration and discovery of knowledge and differentiated learning that takes into account students' individual needs, students can experience significant improvement in critical thinking skills. This is because they are given the

opportunity to engage in discussion, research and problem solving that demands the use of critical thinking skills in a context that is relevant and meaningful to them. As a result, students can develop the ability to think critically, analyse information better, and make better decisions in a variety of situations. This study was conducted in a specific educational environment with a sample of students who may have different characteristics and backgrounds. Therefore, the results may not be directly applicable to various other educational contexts. To broaden the generalizability of the findings, further research with a more representative sample and across different educational settings needs to be conducted.

For more in-depth and sustainable future research related to the development of students' critical thinking skills through the differentiation approach in guided inquiry, the researchers provide recommendations for conducting long-term research that involves periodic monitoring and evaluation of the development of students' critical thinking skills over time. This study can provide insight into the sustainability of the effects of implementing a differentiated learning approach in guided inquiry.

4. Conclusions

This study aims to measure the effectiveness of differentiated learning in the Guided Inquiry model on the development of students' critical thinking skills. Based on the data analysis conducted, it is concluded that the application of the learning strategy significantly improves students' critical thinking skills with an average n-gain of 0.8, which is in the high category. This improvement indicates that the differentiated learning approach in guided inquiry is an effective method for developing students' analytical, problem-solving and critical thinking skills.

In addition to the improvement in critical thinking skills, the results of this study were also supported by the positive responses of the students. Most students were satisfied with the applied learning process, with 63% of students strongly agreeing and 37% agreeing that they felt the benefits of this approach. They felt more challenged and motivated to develop their critical thinking skills through more focused and individualised activities.

The contribution of the research to education is to enrich the literature on differentiated learning in guided inquiry and to provide strong empirical evidence of its effectiveness in improving students' critical thinking skills. It also highlights the importance of teaching models that are responsive to individual student differences.

Implications for educators and policymakers include the need to train educators to implement differentiated learning in guided inquiry, and to integrate this approach into educational policies and national curriculum standards in order to prepare students to face real-world challenges with better critical thinking skills.

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