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The Effect of Differentiated Learning on Understanding of Concepts In The Form of Practicum on The Opportunity Material In Grade X

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Abstract

This study was conducted to identify the extent to which differentiated learning influences students' understanding of mathematical concepts. The focus of this study was the probability material, which was taught to grade X students at SMA Negeri 1 Percut Sei Tuan in the 2025/2026 Academic Year. The experimental class was taught with a differentiated learning approach in the form of practicums. Data collection instruments consisted of observations and tests. Based on the results of the analysis, a significance value (Sing. 2-tailed) of <0.001 was obtained, which is below the 5% significance level (0.05). this indicates that there is a significant influence of differentiated learningin the form of practicums on students' understanding of mathematical concepts on the probability material in the grade X of SMA Negeri 1 Percut Sei Tuan. The results of the data analysis showed that the influence of differentiated learningin in the from of practicums on conceptual understanding was 71,3%..

Keywords: Differentiated Learning, Practical Work, Conceptual Understanding, Opportunities

INTRODUCTION

The progress and growth of a nation depend heavily on its human resources. A nation is only considered advanced if it meets the standards of science, technology, and the arts. The modern era has benefited all humanity, as evidenced by advances in industry, technology, agriculture, medicine, and various other fields. Discoveries in these various sectors demonstrate how humans contribute to the production of high-quality human resources, which requires high-quality education.

Education is a human endeavor to help students develop and enhance useful knowledge, skills, beliefs, attitudes, and behavioral patterns, or to develop socially acceptable personalities. The goal of education is to make the younger generation more humane.

According to Government Regulation of the Republic of Indonesia Number 57 of 2021, Chapter I Article I concerning National Education Standards, education is a conscious and focused effort to create conditions in the learning process that enable students to actively develop their abilities to have personality, religious spirituality, noble morals, self-control, intelligence, and the skills needed by themselves, society, the nation, and the state.

Overall, the quality of Indonesian students is far from satisfying their hearts compared to not getting old, especially when they are already old. Siti Ari is an antidote to the fact that Indonesian students are not motivated enough, yes, because the curriculum is high standard and burdensome, the ti nekul stimulates creativity and does not have the potential to grow. (Falah & Hadna, 2022) .

The international benchmark for literacy is the Program for International Student Assessment (PISA), conducted by the Organization for Economic Co-operation and Development (OECD). This survey aims to evaluate students' literacy-related cognitive skills in various countries to map their ability to process information and apply knowledge to new situations. PISA evaluates three literacy domains: science literacy, mathematics literacy, and language literacy (reading). Indonesia ranked 68th out of 81 countries in 2022, according to the latest poll results published on December 5, 2023. This figure is lower than in 2018, when it ranked 62nd out of 70 participating countries. Unfortunately, Indonesia remains among the top 10 countries with the lowest literacy rates. Specifically, by comparing the PISA survey results in various fields with the components of the School Literacy Movement activities, the results can be used to assess the National Literacy Movement in the area of the School Literacy Movement (Hasanah, 2024) .

Mathematics is the study of quantity, structure, geometric shapes, and changes in numbers. The word "mathematikos," which means exact science in Greek, comes from the word "Wiskunde," which means knowledge in Dutch. According to the Great Dictionary of the Indonesian Language, mathematics is the science of numbers and everything related to them, including all operational procedures used to solve problems involving numbers. A mathematician is someone who specializes in mathematics, and the word "mathematics" is also used to refer to something that is very certain and precise. Mathematics is a tool for thinking, communicating, and solving problems. Mathematics can help develop reasoning, logical thinking, creative thinking, problem-solving, and other mathematical skills. (Ryan & Bowman, 2022)

Many students don't question the rationale behind mathematics instruction; they simply absorb the knowledge. The perception that mathematics is a topic that simply confuses students and that classroom instruction doesn't support mathematics learning is not uncommon. Understanding concepts, proofs, algorithms, problem-solving techniques, appreciation, and psychomotor skills are all components of mathematics learning. One of the problems that often arises in junior high schools is conceptual understanding in mathematics learning (Sari, 2019) .

Differentiated learning is a strategy that enables more individualized education and adapts to students' specific needs. By modifying content, methods, and learning products, teachers can create a more inclusive learning environment. Active engagement is enabled by making students with varying skill levels and learning preferences feel more valued and inspired to learn. The goal of differentiated learning is to offer specific learning opportunities tailored to each student's interests, learning preferences, and skill level. Instructors facilitate learning by understanding student needs.

By connecting observational data with previously learned theory, students can develop relevant concepts through practical learning. Students can also use practical exercises to solve mathematical problems. The use of practical tools in learning activities has

not been optimally implemented by teachers, resulting in minimal student understanding of mathematics material, which they find challenging, resulting in a decline in student conceptual understanding (Shofwani et al., 2023) .

Students who receive mathematics lessons that are synonymous with formulas and symbols sometimes struggle to learn the subject because they don't fully grasp mathematical ideas. The majority of students can only understand the ideas; they cannot use them to solve problems. (Panjaitan et al., 2022) .

To master mathematics, conceptual knowledge is crucial. With conceptual knowledge, students will be better able to solve mathematical problems. This is because rules are necessary for problem-solving. These guidelines are based on previously accepted ideas, making it easier for students to solve mathematical problems (Nurani et al., 2021) . Understanding mathematical concepts is crucial for students because these concepts are the foundation for understanding principles and theories. Therefore, students must first understand the concepts that form theories and principles before they can understand them (Diana et al., 2020) . According to Sholihah and Mubarok, students are still unable to solve mathematical models that have been constructed using actions, processes, objects, and schemes, as well as using concepts and procedures to solve problems relevant to everyday life (Pramesti & Mampouw, 2020) . In reality, Indonesian students still lack a comprehensive understanding of mathematical concepts and communication techniques. The PISA survey report, which ranked Indonesia 72nd out of 78 countries, is proof of this. (Hidayat et al., 2022) . This finding shows that Indonesian students' conceptual knowledge is still lacking.

Conventionally, a laboratory is defined as a place for a group of people to conduct various kinds of observational activities. The term "laboratory" can refer to a closed room, a room, or an open space. This term also refers to research, training, and various scientific tests as a means to bridge the gap between learned theory and practice in various fields. Besides often being considered a location where educational resources are used, laboratories can also take the form of a campus or classroom, an environment or nature, a social institution, or even society itself. A common benchmark for student achievement is the laboratory, where practical work is carried out (Sebastian Sitompul et al., 2024) . Therefore, the creation of laboratories in all their forms is important for the teaching and learning process.

Probability is a mathematical discipline taught in high school. The idea of likelihood (chance) associated with an event is related to probability. Isrok'atun claims that gamblers, or those who regularly play games with the goal of winning, were the first to coin the concept of probability. Although rooted in gambling, probability is now a popular mathematical term, for example in business, research, and industry. By collecting, selecting, evaluating, and explaining the potential outcomes of uncertain phenomena, the study of probability actually helps people make better decisions regarding unknown events or occurrences.

Chance is a number that indicates how likely something is to happen. Another popular term for chance is probability. The topic of probability is closely related to everyday life. Remember that there are many opportunities in life. Rolling dice is one example of how probability theory is used in everyday life. Students often struggle with probability, especially when trying to answer story-based exercises. This can hinder their understanding

of the subject matter and impact their learning objectives. Therefore, teachers actively participate in the educational process by introducing innovations and making periodic and continuous adjustments to the learning process. Differentiated learning is one innovation used to help students meet their needs and improve their conceptual knowledge, which will improve their learning outcomes. Based on field observations during a useful field survey at SMA Negeri 1 Percut Sei Tuan, experts identified problems in mathematics learning. The majority of 10th-grade Matlanfor students failed the 2024/2025 semester mathematics final exam under the KKTP at SMA Negeri 1 Percut Sei Tuan. This indicates that mathematics teachers continue to provide remediation to students (Herwina, 2021) .

Based on observations at SMA Negeri 1 Percut Sei Tuan and interviews with mathematics teachers and several 10th-grade Matlanfor students, he stated that students' mathematics learning outcomes were still low, as were their understanding of material concepts and their level of student engagement in the subject matter. Students were also less motivated to learn during class practice, which indirectly impacted their grades. Furthermore, researchers who directly observed learning activities found that teachers still used traditional learning models without actively involving students.

Students find learning mathematics boring and uninteresting because it focuses solely on formulas. They are not actively developing their learning interests because these boring learning activities are teacher-centered and repetitive. In school, there is also a lot of material that can be practiced. SMA Negeri 1 Percut Sei Tuan Medan is one of the state schools accredited A. However, the implementation of practical work at the school still faces many obstacles. One mathematics teacher stated that students' grades during practical work are still low, resulting in minimal practical work implementation at the school.

One of the teacher elements that causes learning challenges in mathematics is the lack of understanding of the related learning tactics and approaches that must be used in each class. (Sari, 2019) . Currently, it seems that teachers have full authority over the class. Students are the subject and the teacher is the object; learning takes place one way, with students only receiving information. (Liando, 2022) . As Hamdun stated, learning that focuses on the teacher and not on student skills is known as conventional learning. (Bramantha & Meliandani, 2024) . Based on this, the conventional learning process using a lecture model and teacher-centered learning is one-way and less, making the subjects presented very boring by integrating students in the mathematics learning process in class, and does not pay attention to the needs of students including learning styles so that as a result, student learning outcomes are decreasing and learning objectives are not achieved, the researcher is interested in conducting research on " Differentiated Learning Against Concept Understanding in the Form of Practicum".

METHOD

This research will employ quantitative research with an experimental method characterized by a trial-and-error approach. Measuring multiple variables is a technique used in quantitative research to strengthen a theory. Numerical data is then generated through statistical analysis of these measurements. Generally, tables, graphs, and other visual representations are used to present the results. In addition to providing a methodical overview of the impact of differentiated learning on conceptual knowledge through

practice, the purpose of this quantitative technique is to validate and create theories and hypotheses related to an item or phenomenon (Sebastian Sitompul et al., 2024) .

The research design used was a quasi-experimental with a *post-test only control group design*. Through this design, researchers can measure conceptual understanding in the form of practical work before and after the implementation of differentiated learning to determine whether there is an effect or change. This design is useful for measuring the effect of differentiated learning on conceptual understanding in the form of practical work without a control group, considering that learning is carried out in a fixed classroom.

This research was conducted in the 10th grade students of SMA Negeri 1 Percut Sei Tuan, located at Jln. Irian Barat, Sampali Village No. 37, Medan Housing Complex, Percut Sei Tuan District, Deli Serdang Regency. This research will be conducted throughout the 2025–2026 academic year, specifically from July to August 2025.

According to Sugiyono in (Laia et al., 2022) Population is a comprehensive category consisting of products or subjects characterized by precise numbers and features, which researchers use to analyze and then extrapolate their findings. Consequently, every object or subject of research selected by researchers is included in the population. The population in this study was all students of the 2025/2026 class of Class X of SMA Negeri 1 Percut Sei Tuan which consisted of 10 classes with a total of 300 students.

According to Sugiyono in (Sitorus et al., 2022) , a sample is part of the overall size and composition of a population. Demographics include all 10th-grade students of SMA Negeri 1 Percut Sei Tuan. The sample for this study was selected purposively, specifically class X-4. The purpose of sample selection was to ensure that the characteristics of the subjects were in accordance with the objectives of this study. To collect information and data that would be useful as supporting evidence in conveying conclusions, the researcher used a data collection methodology. In this study, the researcher collected data through tests and observations.

RESULTS AND DISCUSSION

The purpose of this quasi-experimental study, conducted at SMA Negeri 1 Percut Sei Tuan, was to determine how variations in learning in the form of practicums affect the conceptual understanding of grade X students. All 36 students of grade X-4 of SMA Negeri 1 Percut Sei Tuan became the experimental group in this study, while the population consisted of all grade X students. The experimental class implemented differentiated learning in the form of practicums during the learning process. The researcher delivered material about the probability of an event and also how to determine events, sample spaces and determine probability formulas to help students understand mathematical concepts more effectively. Five descriptive questions formed a post-test, which was given to students as a final assessment of learning outcomes after the learning process was completed (Safitri & Juliati Nasution, 2023) .

The researcher initially tested the questions to be tested before starting data collection. The questions to be tested will be tested on class XI Matlanfor with a total of 35 students. This testing aims to ensure the validity, reliability, discriminating power, and level of difficulty of the test. From the instrument trials that have been conducted, the following data were obtained: The question items are valid at the $\alpha = 0.05$ level with $N = 35$ when the Product Moment Correlation algorithm is used to determine validity, provided that r count

> r table. All questions are valid based on the results of the validity test calculations shown inTable (Herwina, 2021) . Data will be collected using a total of five valid questions.

Research Hypothesis Testing

After completion of the initial normality test and confirmation that the data were normally distributed, the study continued using hypothesis testing.

Regression Analysis Results

Regression Linearity Test

Table 1. Regression Linearity Test

ANOVA Table			Sum of Squares	df	Mean Square	F	Sig.
Test Observation_Value	*Between Groups	(Combined)	3478.532	5	695,706	18,216	<.001
		Linearity	3298.074	1	3298.074	86,354	<.001
		Deviation from Linearity	180,458	4	45,115	1,181	.339
	Within Groups		1145,774	30	38,192		
	Total		4624.306	35			

Based on SPSS calculations, the calculated F is 1.181 and the significant variation from the linearity value is 0.339. The F table value of 2.69 is then compared with the calculated F value. Based on the hypothesis test, if the calculated F value < F table , there is a linear relationship. The calculation shows a linear relationship with 1.181 < 2.69 and a significant deviation from the linearity value of 0.339 > 0.05.

Simple Regression Equation

The purpose of a basic regression equation is to test the relationship or influence between independent and dependent variables (Mehan et al., 2023) . This study uses a direct regression test to investigate how diverse learning influences students' conceptual knowledge through practical activities (Ade Sintia Wulandari, 2022) .

Table 2. Simple Linear Regression Test

Coefficients [a]					
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	59,264	2,470		23,993	<.001
Observation_Value	1,206	.131	.845	9,195	<.001

a. Dependent Variable: Experiment

From the results of the data analysis, the value of a was 59.264 and b was 1.206, so that the following regression equation was obtained:

$\hat{Y}$ = 59,264 + 1,206 X

According to this equation, students' conceptual understanding is positively influenced by diverse learning through practice, as seen from the regression coefficient b of 1.206 (Bendriyanti, Dewi, & Nurhasanah, 2022)

Regression Significance Test

Table 3. ANOVA table

ANOVA [a]						
Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
1	Regression	3298.074	1	3298.074	84,551	<.001 [b]
	Residual	1326.232	34	39,007		
	Total	4624.306	35			

a. Dependent Variable: Experiment

b. Predictors: (Constant), Observation_Value

$F_{count} \geq F_{table}$ = 2.69 is determined using the calculation in Table 4.8 ANOVA, which means 84.551 ≥ 2.69 with a significance level of <0.001 < 0.05. Therefore, it can be said that the student's conceptual understanding practicum is an example of differentiated learning.

Coefficient of Determination

Table 4. Test Results R^2

Model Summary				
Model	**R**	**R Square**	**Adjusted RSquare**	**Standard Error of the Estimate**
1.	.845 [a]	.713	.705	6,246

a. Predictors: (Constant), Observation_Value

The determination test produced an R value of 0.845 and a coefficient of determination R_{Square} of 0.713 based on the results of the data processing test conducted with SPSS. Differentiated learning through practicum has an influence of 71.3% on students' conceptual knowledge, based on SPSS data processing with the calculation of KP = 0.713 x 100% = 71.3%. The remaining 28.7% is influenced by factors outside the scope of the study (Hadi et al., 2022) .

***N-gain* test**

The N-gain calculation was conducted to determine the extent to which the practicum improved students' conceptual knowledge based on observations and post-test results in the experimental class. In this case, the N-gain calculation aims to determine whether varied learning in the form of practicums can improve students' conceptual understanding (Farid et al., 2022) .

N-Gain calculation in this study using SPSS can be seen more clearly. Based on the calculation, the results obtained are as shown in Table 4.10 as follows:

Table 5. *N-Gain* Results

	N	Minimum	Maximum	Mean	Standard Deviation
Gain_score	36	.58	1.00	.7661	.12166
Gain_percent	36	57.89	100.00	76.6074	12.16617
Valid N (listwise)	36				

Therefore, it can be said that strengthening students' conceptual knowledge of opportunity information is the result of diversifying learning through practical activities.

Research Discussion

Thus, it can be concluded that differentiated learning in the form of practical work has an effect on increasing students' conceptual understanding of the material on probability.

Because the data analysis shows a relationship between the two variables, as evidenced by $t_{count} > t_{table}$, based on the research findings, Ha_{is} rejected and Ha is accepted. This indicates a strong correlation between students' understanding of mathematical concepts and differentiated learning in the form of practicum. Based on the results of the regression test, the coefficient of determination $R2^{is}$ 0.713, which means that differentiated practicum learning contributes 71.3% of the difference in conceptual understanding, while the rest is influenced by characteristics not examined by the researcher. Simple regression calculations produce the equation ɜ = 59.264 + 1.206X. Based on this equation, both variables have an influence, as indicated by the regression direction coefficient (b) = 1.206 (Syahputri et al., 2023) . This shows that the impact of individual learning in the form of practicum of 1.205 will improve students' understanding of mathematical ideas (Pitaloka & Arsanti, 2022) .

The N-gain results obtained an average experimental class score of 0.76 with high criteria, thus it can be stated that there was an increase in students' knowledge of mathematical ideas through practical activities in class X of SMA Negeri 1 Percut Sei Tuan (Rosyah & Darmawan, 2023) .

Based on these findings, the researchers reached conclusions that support the initial hypothesis, which stated that students' conceptual understanding of mathematics improves through practice when a differentiated learning approach is used. This demonstrates how hands-on learning can increase students' self-confidence.

CONCLUSION

The formulation of the problem, the proposed hypothesis, and the findings of the research data analysis resulted in the following conclusions:

1. At SMA Negeri 1 Percut Sei Tuan, differentiated learning had a significant impact of 71.3% on students' understanding of practical concepts in the probability curriculum during the 2025–2026 academic year.
2. There was an increase in students' understanding of practical concepts in the material on probability at SMA Negeri 1 Percut Sei Tuan with an increase of 76.6%.

Suggestion

The researchers made a number of recommendations based on these findings, some of which are included below. :

1. In implementing mathematics learning, it is hoped that ideally the emphasis will be on the role of students so that they are able to actively participate in mathematics learning .
2. Teachers are expected to be able to use a differentiated learning approach in the form of practical work as an alternative learning strategy, especially to improve students' understanding of mathematical concepts.
3. Students are expected to be more active in understanding the material on probability and have a strong conceptual understanding to solve problems and issues in the material on probability .
4. Due to the limitations of the study, further research is recommended, applying the learning model to various themes with a larger sample size. This will ensure more representative and credible results.

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