

# THE EFFECT OF DIFFERENTIATED LEARNING MODELS ASSISTED WITH IMAGES TO IMPROVE STUDENTS' UNDERSTANDING OF MATHEMATICS

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## Abstract

The purpose of this study was to determine the effectiveness of the teaching aids-assisted differentiation model on mathematical problem solving abilities. The population in this study were students of class VII SMP Negeri 4 Tegal. Sampling using probability sampling using Cluster Sampling. This research method uses the right-sided t test. The results of the study stated that students who were taught using the differentiated learning model assisted by snakes and ladders props were better than conventional learning by calculating the right-sided t test.

Keyword: *differentiation, problem solving, conventional.*

## 1. INTRODUCTION

Education is said to be a life process to develop all individual potentials so that they can live and be able to live life as a whole so that they become educated human beings, both cognitively, affectively, and psychomotor. School is a formal educational institution for learning as well as a place for receiving and giving lessons. Education will always develop in harmony with increasingly sophisticated technological developments. Therefore, schools are required to always improve the quality of learning so that it is by the increasingly developing times.

In February 2022, the government officially launched an independent curriculum, which is a learning method that refers to talents and interests. That way, students can develop their potential with the facilitation of the teacher. Each student has a unique and diverse potential within him as happened to the students of Junior High School 4 Tegal. According to Mrs. Lilis as a mathematics teacher, the students at SMP Negeri 4 Tegal in each class had different ways of capturing learning.

The use of differentiated learning methods is better than direct learning in terms of student learning outcomes. It can be seen that differentiated learning has a higher level of completeness than direct learning (Rezeki Noris Pane, Sorta Lumbantoruan, and Sinta Dameria Simanjuntak. 2022). Research conducted by Usman (2018) shows that the average student learning outcomes in mathematics are above the KKM score with a classic mastery level of 86.67%. This proves that the application of problem-based learning with differentiation learning strategies can improve student learning outcomes.

According to Jatmiko (in Archy Suzana Dewi, Isnani, and Ahmadi) In general, learning difficulties in solving math problems are: The strategies used by teachers are unusual and less efficient, students do not understand problems and do not understand solving procedures, and do not understand problem-based context. Some teachers use conventional learning methods by looking at all the uniqueness and diversity of students as the same which results in students not being able to understand the problem so they cannot understand the questions and solving procedures.

From the above opinion, this research aims to describe students' mathematical problem-solving abilities using differentiated learning models assisted by snakes and ladders teaching aids better than conventional learning models.

Differentiated learning is an attempt to adapt the learning process in the classroom to meet the individual learning needs of each learner (Tomlinson, 2001). These adjustments regarding interests, learning profiles, and readiness of students to achieve an understanding of students' problem-solving.

## 2. METHODOLOGY

### A. Instrumen tes

#### 1. Validity Test

In testing the validity of the test, the product moment formula can be used because it uses polytomous construct validity.

#### 2. Reliability Test

Reliability testing using the Cronbach Alpha test was carried out for instruments that had more than 1 correct answer. If  $r_{\text{count}} \geq 0.355$ , then the test was reliable. If  $r_{\text{count}} < 0.355$ , then the test is not reliable.

### 3. Difficulty Test

The level of difficulty of the test items can be determined by the percentage of subjects who answered correctly. The test criteria can be determined, namely  $0.000 \leq TK \leq 0.300$  is difficult  $0.300 < TK \leq 0.700$  is moderate  $0.700 < TK \leq 1.000$  is easy.

### 4. Power Difference Test

Students who take the test are divided into two, namely clever and less intelligent by looking at the results of the odd semester PAS with the test criteria being determined if  $0.700 < DP \leq 1.000$  then very good, if  $0.400 < DP \leq 0.700$  is good, if  $0.200 < DP \leq 0.400$  is enough, if  $0.000 < DP \leq 0.200$  then the differential power is bad.

## B. Test prerequisite analysis

### 1. Normality Test

In the normality test using the Liliefors test. According to Sudjana (2005) states what is done is as follows:

#### 1) Determine the Hypothesis

$H_0$  : sample comes from a normally distributed population

$H_1$  : samples come from non-normally distributed population

#### 2) Significance level $\alpha = 5\%$

#### 3) Criteria area

$H_0$  is rejected if  $L_{\text{count}} \geq L_{\text{tabel}}$  then the sample is not normally distributed.

$H_0$  is accepted if  $L_{\text{count}} < L_{\text{tabel}}$  then the sample is normally distributed.

### 2. Homogeneity Test

Homogeneity test using the Barlett test. The steps for testing data homogeneity with the Bartlett test are as follows (Sudjana, 2005):

#### 1) Determine the Hypothesis

$H_0$  : sample comes from a population that has a homogeneous diversity.

$H_a$  : sample comes from a population that has an inhomogeneous diversity.

#### 2) The significance level of $\alpha$ used is 5%

#### 3) Criteria area

Reject  $H_0$  if  $\chi^2 \geq \chi^2_{(1-\alpha)(k-1)}$

Accept  $H_0$  if  $\chi^2 < \chi^2_{(1-\alpha)(k-1)}$

## C. Hipotesis test

Test the hypothesis using one sample t right-sided test. According to Isnani (2014: 61) the steps for one sample t right-sided test are as follows:

### 1) Determine the hypothesis

$H_0: \mu_1 \leq \mu_2$  means that the ability to solve mathematics taught using the differentiated learning model assisted by snakes and ladders is not better than the conventional learning model.

$H_1: \mu_1 > \mu_2$  means that the ability to solve mathematics taught using the differentiated learning model assisted by snakes and ladders is better than conventional learning models.

### 2) Determine the level of significance $\alpha=5\%$

### 3) Determine the area of testing criteria

$H_0$  is not rejected if  $t_{\text{count}} \leq t_{(\alpha,v)}$

$H_0$  is rejected if  $t_{\text{count}} > t_{(\alpha,v)}$

### 4) Test Statistics

The statistical test formula is:

$$t_{\text{count}} = \frac{\bar{y}_1 - \bar{y}_2}{\sqrt{s^2 \left( \frac{1}{n_1} + \frac{1}{n_2} \right)}}$$

$$\text{if } s^2 = \frac{(n_1-1)s_1^2 + (n_2-1)s_2^2}{n_1+n_2-2}$$

### 5) Analysis and conclusions

## 3. RESULT

The approach used in this research is quantitative. Quantitative research is a research method that is inductive, objective, and scientific in which the data obtained is in the form of numbers (scores, values) or statements that are assessed, and analyzed by statistical analysis (Iwan Hermawan, 2019: 16) . This study uses a quasi-experimental method. This research was conducted on March 13 - April 6 2023 at Junior High School 4 Tegal.

Population is a generalized area consisting of objects or subjects that have certain qualities and characteristics determined by researchers to study and then draw conclusions (Sugiyono, 2017). The population of this study were students consisting of 6 class VII semester II of Junior High School 4 Tegal Tegal for the 2022/2023 academic year, namely class VII A – VII F with a 186 students.

The sample is part of the population in the form of numbers and characteristics (Sugiyono, 2017). The samples of this study were class VII D as the trial class, class VII E as the experimental class, and class VII F as the control class. The sampling technique uses probability sampling using Cluster Sampling.

**Table 1. The Value of Understanding Mathematical Concepts**

Class Size	Experiment Class	Control Class
Higest Rated	58	48
Lowest Rated	40	32
Mean	49,742	40
Median	50	40
Modus	48	36
Varians	16,198	18,4
St. Deviation	4,025	4,29
CV	0,081	0,107

Based on the table above, it can be seen that the mean, median, and mode values are close or almost the same for the experimental class in the range of 39-40 and for the control class in the range of 41-42, so the value of the data distribution curve for the two classes is symmetrical following the normal curve.

#### 4. DATA ANALYSIS

##### A. Instrumen Tes

###### 1. Validitas Test

**Table 2 Validitas Test**

Question Number	$r_{count}$	$r_{tabel}$	Conclusion
1	0,673	0,355	Valid
2	0,871	0,355	Valid
3	0,682	0,355	Valid
4	0,624	0,355	Valid
5	0,053	0,355	Invalid
6	0,856	0,355	Valid

Based on the table above, it can be concluded that before the test instrument there were 6 questions, after being validated, there were 5 questions that were said to be valid, namely questions number 1, 2, 3, 4, and 6 because  $r_{count} > r_{tabel}$ .

###### 2. Reliabilitas Test

**Table 3 Reliabilitas Test**

$r_{count}$	$r_{tabel}$	Conclusion
0,801	0,355	Reliabel

Based on the table above it can be concluded that the test instrument is said to be reliable because  $r_{count} > r_{tabel}$ .

###### 3. Difficulty level

**Table 4 Difficulty level**

Question Number	TK	Conclusion
1	0,8	Easy
2	0,6	Currently
3	0,64	Currently
4	0,63	Currently
5	0,31	Currently
6	0,41	Currently

Based on the table above, it can be concluded that there is 1 question in the easy category, namely number 1 because  $0,700 < TK \leq 1,000$  and there are 5 questions in the medium category, namely numbers 2, 3, 4, 5, 6 because  $0,300 < TK \leq 0,700$ .

###### 4. Different Power

**Table 5 Different power**

Question Number	DP	Conclusion
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1	0,325	Enough
2	0,575	Good
3	0,25	Enough
4	0,208	Enough
5	0,013	Bad
6	0,575	Good

Based on the table above, it can be concluded that there is 1 question in the bad category, namely number 5 because  $0,000 < DP \leq 0,200$ , there are 3 questions in the moderate category, namely numbers 1, 3, and 4 because  $0,200 < DP \leq 0,400$  then there are 2 questions in the good category, namely number 2, and 6 because  $0,400 < DP \leq 0,700$ .

**B. Test prerequisite analysis**

1. Normalitas Test

**Table 6 Normalitas Test**

No	Kelas	$L_{count}$	$L_{tabel} (\alpha=0,05)$	Conclusion
1	Eksperimen	0,152	0,1591	Normal
2	Kontrol	0,147	0,1591	Normal

Based on the table above, it can be concluded that the data on mathematics learning achievement before and after the study is normally distributed because  $L_{count} < L_{tabel}$ .

2. Homogenitas Test

**Table 7 Homogenitas Test**

$\chi^2_{count}$	$\chi^2_{tabel}$	Conclusion
0,122	3,841	Normal

Based on the table above, it can be concluded that the data on mathematics learning achievement before and after the study is homogeneous because  $\chi^2_{count} < \chi^2_{tabel}$ .

3. Hipotesis Test

**Table 8 One Sample t Right-Sided Test**

No	$t_{count}$	$t_{tabel}$	Conclusion
1	9,222	2,04	$9,222 > 2,04$

The results of the table above show that  $t_{count} = 9,222$  then the results are consulted with the value of the t table using a significance level of  $\alpha = 5\%$ , then  $t_{tabel} = 2,04$ . Because  $t_{count} > t_{tabel}$ ,  $H_0$  is rejected so  $H_a$  is accepted, which means that students who are taught using a differentiated learning model assisted by snakes and ladders have better solving abilities than conventional learning models.

**SESSION**

Based on the results of research conducted at Junior High School 4 Tegal on students in class VII even semester of the 2022/2023 school year the subject matter of transformation shows that students who are taught using the differentiated learning model assisted by the snake and ladder visual aid are better than participants who are taught using conventional learning models . This is because students who are taught using a differentiated learning model take a variety of approaches in content, processes and products and then adjust the learning process to meet the learning needs of each student rather than conventional learning.

This statement is in accordance with research conducted by Rezeki Noris Pane, Sorta Lumbantoruan, and Sinta Dameria Simanjuntak (2022) which shows that the use of differentiated learning methods is better than direct learning in terms of student learning outcomes. This is because differentiated learning is an adjustment to interests, learning preferences, student readiness to achieve increased learning outcomes

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conclusion

The ability to solve mathematical problems of students who are taught using the differentiated learning model assisted by snakes and ladders visual aids is better than students who are taught using conventional learning models.

Suggestion

1. Teachers should be able to meet the diverse learning needs of each student by using an appropriate learning model, such as a differentiated learning model.
2. Teachers are expected in the process of learning mathematics to motivate students by increasing students' enthusiasm for learning in learning.
3. Students should be motivated by something conveyed by the teacher and be more active in learning because this has a positive effect on their ability to solve mathematical problems.

**REFERENCES**

- Dewi, Archy Suzanna, Isnani, Ahmadi, 2019, Keefektifan Model Pembelajaran Stad Berbantuan Media Pembelajaran Terhadap Sikap Dan Kemampuan Pemecahan Masalah Matematika. 1(4), 7-11.
- Hermawan, Iwan. 2019. Metodologi Penelitian Pendidikan Kuantitatif, Kualitatif & Mixed Methode. Kuningan: Hidayatul Quran Kuningan.
- Hidayati, F., Isnani, L., & Susongko, P. 2017. *Pengaruh Persepsi Peserta Didik Pada Pembelajaran Matematika Terhadap Prestasi Belajar Matematika di Sekolah Menengah Pertama*. JPMP (Jurnal Pendidikan MIPA Pancasakti), 1(1).
- Mustami, Siska Sagita, Paridjo, Wikan Budi Utami. 2020. Efektifitas Pembelajaran Melalui *Whatsapp Grup* terhadap Kemampuan Pemecahan Masalah. Skripsi Universitas Pancasakti Tegal.
- Novratilova, Diana, Nina Kadaritna, Lisa Tania. 2015. Efektivitas *Problem Solving* dalam Meningkatkan Keterampilan Mengelompokkan dan Menyimpulkan pada Asam Basa. Jurnal Pendidikan dan Pembelajaran Kimia. 3(4), 782-794.
- Pane, Rezeki Noris, Sorta Lumbantoruan, dan Sinta Darmeria Simanjuntak. 2022. Implementasi Pembelajaran Berdiferensiasi Untuk Meningkatkan Kemampuan Berpikir Kreatif Peserta Didik. Jurnal Multidisiplin Ilmu. 03(1), 173-180.
- Sudjana, Nana. 2005. Metoda Penelitian. Bandung: Tarsito.
- Sugiyono. 2017. Statistika Untuk Penelitian. Bandung : Cv Alfabeta.
- Tomlinson, C. A. 2001. *How to Differentiate Intruccion in Mixed-Ability Classrooms 2<sup>nd</sup> Ed.*
- Usman, M. 2018. Penerapan Pembelajaran Berbasis Masalah dengan Strategi Pembelajaran Diferensiasi pada Peserta Didik Kelas VIII. Issues in Mathematics Education Journal.