



## The Effect Of Puzzle Media-Assisted Discovery Learning Model On Students' Conceptual Understanding Of Fraction Material In Grade VII

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### Article History:

Accepted: 9 July 2025

Revised: 11 November 2025

Published: 7 December 2025

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### Abstract

The purpose of this research was to analyze the effects on seventh graders' conceptual knowledge of fractions during the 2025–2026 school year at SMP Negeri 1 Namorambe using a discovery learning strategy based on puzzles. The technique employed a quasi-experimental approach with two groups of students chosen at random from clusters: one group served as an experimental unit with 34 students, while the other group served as a control unit with 35 students. Unlike the control group, who received traditional instruction, the experimental group used a puzzle-assisted discovery learning paradigm. The data was gathered via observation sheets and essay exams. The findings of the data analysis showed that at a significance level of 5%, the model had a substantial impact on students' conceptual knowledge, as shown by a Sig. (2-tailed) value of  $0.00 < 0.05$ . Students' conceptual knowledge was enhanced to 37.4% using the puzzle-assisted discovery learning technique.

**Keywords:** Influence, Discovery Learning Model, Puzzles, Conceptual Understanding.

### INTRODUCTION

When it comes to a nation's progress, education is a key component. Quality human resources, including educated individuals capable of contributing to the advancement of science and technology, are crucial, and education plays a significant role in meeting this need. A dignified culture, the development of individual potential, and the formation of strong moral character are the principles of national education policy, which is why it aligns with these goals (Simanjuntak, Siregar, & Lumbangaol, 2019). Various academic disciplines contribute to this goal-oriented education (Sukadari et al., 2023). One of them is mathematics, which is a compulsory subject and plays a strategic role in the learning process (Muswaroh, 2018). Therefore, we all work towards the same goal: mastering the mathematics objectives outlined in the curriculum (Khamidah, Winarto, & Mustikasari, 2019). The primary goal of mathematics education is to help students become better thinkers by developing their abilities in abstract reasoning, conceptualization, representation, and the use of appropriate algorithms to solve problems (Ahmadah, Setiawan, & Ardianti, 2020).

The discovery learning model is an approach in which students actively seek out the material to be studied, without the teacher providing complete information. According to Dari & Ahmad (Yunita & Supriatna, 2021) Discovery Learning is a conceptual learning framework that does not present complete teaching materials by the teacher. Instead, students are encouraged to identify their information needs, search for data independently, and discover the concept themselves (Widyatmoko, 2019).

According to Juwita (2023), in today's modern era, technological developments have expanded into various fields, including education down to the elementary school level. This progress makes it easier for educators to design innovative learning media. One effective option is the use of puzzles for fractions. This media helps students understand the material while also practicing their ability to follow instructions to achieve their goals. Furthermore, fraction puzzles serve as a reinforcement tool for recalling addition and subtraction of mixed fractions. This media is engaging and can provide a more meaningful learning experience for students (Setiana, Rahayu, & , 2019).

Students' low understanding of mathematical concepts can occur because they are unable to grasp the meaning of the concepts they have learned, leading to their quickly forgetting this knowledge. Furthermore, students often fail to understand the purpose or intent of a problem before attempting it, leading them to perceive it as difficult (Bahar & Risnawati, 2019). Yet, conceptual mastery is a crucial foundation and crucial stage in the overall mathematics learning process (Hidayati, 2018).

Applying a discovery learning model, aided by puzzles, to fractions is an effective strategy for optimizing student engagement and strengthening their conceptual understanding. Puzzles encourage discussion and collaboration among students, while discovery learning encourages independent learning and the search for solutions.

From this explanation, it is clear that learning media plays a role in clarifying lesson content and aligning students' perceptions. Various media are available to support teaching and learning activities, but media selection must be tailored to the characteristics of the material to optimally achieve educational objectives (Syafitri, Amir, & Elvinawati, 2019). To address this challenge, innovative media are needed to support mathematics learning about basic fractions, particularly through the development of fraction puzzles (Londa, Mete, & Sadipun, 2018).

In response to this, researchers were interested in conducting a scientific study entitled "The Effect of the Puzzle-Assisted Discovery Learning Model on Students' Conceptual Understanding of Fractions in Grade VII."

## **METHOD**

Researchers used quantitative techniques based on the problem being studied. This strategy is a research method that relies on numerical data to support its claims. Because it aligns with the characteristics of research that demonstrate a quantitative approach, a quantitative approach was chosen (Setiaji, Koeswanti, & Giarti, 2018). Starting from theoretical foundations, expert perspectives, and the researcher's experience, quantitative

research often employs deductive and inductive reasoning processes to define problems and potential solutions. The validity of these formulations is then verified using empirical data collected in the field. Numbers are crucial in this method throughout the research process, from initial data collection and processing to the presentation of final findings (Astuti, Idrus, & Yennita, 2018). To ensure accurate interpretation, the collected data were statistically analyzed. The results of seventh-grade students' final exams were used to assess achievement of mathematics learning objectives, and questionnaires were distributed to measure students' learning motivation (Oktari & Desyandri, 2020).

We used quantitative techniques to determine how seventh-grade students at SMP Negeri 1 Namorambe performed in mathematics after implementing the Discovery Learning concept. To identify the source of the problem, this study first reviewed the hypotheses and relevant information. To confirm or refute the research hypotheses, the problems were evaluated using data collected in the field. The quantitative data consisted of numerically reported motivation assessments and mathematics learning achievement scores (Kadri & Rahmawati, 2015).

A quasi-experimental approach was used in this study. Although there was a control group, the experiment could not be completely free from external influences. Therefore, there were two groups in this study: the control group and the experimental group. The content and objectives of both were the same; the difference was the learning approach used. The control group used traditional learning methods, while the experimental group implemented the Discovery Learning paradigm.

This research was conducted at SMP Negeri 1 Namorambe located on Jl. Namorambe, Namorambe District, North Sumatra. The research was conducted in the even semester of the 2025/2026 academic year. The term "population" refers to a broad category that includes all things or individuals who have characteristics chosen by the researchers to be the focus of their study. Participants in this study were all seventh-grade students at SMP Negeri 1 Namorambe.

A sample in a study is a subset of the overall population that is the focus of the research. Students from one seventh-grade class at SMP Negeri 1 Namorambe served as the experimental group in this study.

Obtaining reliable data is the primary goal of research, making data collection techniques a crucial element in the research process. Researchers will struggle to obtain the necessary data if they do not understand data collection strategies (Sugiyono, 2018). In a research context, there is no fixed pattern for collecting information; instead, it depends heavily on the situation, data sources, and techniques used (Safitri & Mediatati, 2021). From a research perspective, data can be collected in various environments, including natural environments, controlled locations such as laboratories, or even respondents' homes or meeting locations (Rahmayani, 2019). There are two main categories in classification based on data source: primary and secondary. Direct observation, interviews, questionnaires, document studies, or a combination of these techniques may be used by researchers in their implementation. The following are methods used to collect data:

1. Concept understanding test

Students' ability to express themselves mathematically is the primary focus of this exam. To evaluate students' understanding of mathematical communication and their level of comprehension of the topics covered, a written exam with essay questions was chosen. This essay-based exam included a pretest and a posttest. Both the pretest and posttest were

designed to assess the effectiveness of the intervention by measuring participants' skills before and after the intervention (I. D. G. W. Putra, Agung, & Parmiti, 2017). Therefore, students' understanding of the topics and their ability to work with fractions are indicators of their conceptual knowledge (Hendrayani, Sutresna, & Rusyana, 2021).

## 2. Observation

Observation is a technique used to observe behavior, particularly nonverbal behavior. According to Sugiyono (2018:229), the uniqueness of the observation method lies in its flexibility, not only focusing on human subjects but also encompassing various other objects compared to other data collection techniques. Through this approach, researchers have the ability to record and interpret behavior and the meanings contained within. In the current study, observation activities were conducted face-to-face in the classroom to identify students' situations when completing math assignments related to the concept of fractions, which were delivered through the Discovery Learning approach and supported by puzzle media. The focus of observation was directed at the dynamics of student activities and behavior throughout the teaching and learning process.

## 3. Documentation

Sugiyono (2018:476) states that documentation is a data collection method that involves gathering various documents to support research. These documents can include books, archives, notes, reports, drawings, and photographs. Research methods such as documentation studies increase the credibility of data collected through observation and interviews. This is especially true when supporting evidence is provided by relevant images or academic texts. However, not all documents are completely reliable; some may have been prepared for specific reasons and therefore may not accurately reflect the current situation. The implementation of the research in this study was documented through the use of images and videos taken throughout the classroom learning process (Fauziyah & Haryanto, 2024).

An essay assessment measuring students' understanding of mathematics topics and an observation sheet monitoring the dynamics of the learning process were used to collect data in this study (FAJRI, 2019). A pilot test was conducted before the assessment instrument was sent to respondents to ensure high-quality questions. Validity, reliability, difficulty level, and the ability of the questions to differentiate between students were among the assessment criteria used in this pilot test. The following section will describe the methods used to measure each of these components (R. R. Putra, Tandililing, & Arsyid, 2016).

Data analysis is the next step after data collection for this research. Data analysis includes data collection, grouping data into meaningful categories, drawing conclusions, and checking and re-verifying the data to ensure accuracy. Quantitative data processing is the primary analytical strategy used in this research. Analysis is conducted to draw conclusions from the research and test the hypotheses.

## **RESULTS AND DISCUSSION**

### **Research result**

The purpose of this study was to examine the impact of implementing the Discovery Learning Model with puzzle media on students' understanding of fraction concepts at SMP Negeri 1 Namorambe. All seventh-grade students at SMP Negeri 1 Namorambe were considered as research subjects. Class VII-1, which was chosen as the experimental class in this study, consisted of 34 students as the research sample (Kristin, 2016).

## Research Instrument Trial Results

### Test Instrument Validity Test

A two-tailed significance threshold of less than 0.05 was used to assess the reliability of this research test in SPSS 25.0 for Windows. Ten items were found to be valid based on the validity test results conducted using SPSS 25.0 for Windows (Appendix 13). You can see the results of the validity test for these items in Table 4.1 below.

**Table 1. Validity Test**

Amount	Pearson	.595	.671	.762	.711	.486	.562	.437	.516	.731	.572	1
	Correlation			**	**	**	**	*	**	**	**	
	Sig. (2-tailed)	0.001	0.000	0.000	0.000	0.008	0.002	0.008	0.004	0.000	0.001	
	N	29	29	29	29	29	29	29	29	29	29	29

\*. Correlation is significant at the 0.05 level (2-tailed).

\*\*. Correlation is significant at the 0.01 level (2-tailed).

According to the Table, a significance level (two tails) of less than 0.05 was found in 10 of the questions.

### Reliability Test of Test Instruments

Using SPSS 25.0 for Windows and Cronbach's Alpha value criteria  $> 0.60$ , the reliability of this research test was evaluated. Reliable items were generated from the results of the reliability test using SPSS 25.0 for Windows (Appendix 13) (Reinita, 2020).

**Table 2. Reliability Test**

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.800	.808	10

### Difficulty Level

Questions were rated as easy, moderate, or difficult based on the level of difficulty students were able to answer. SPSS 25.0 for Windows was used to analyze the difficulty level of this research test (Appendix 14).

**Table 3. Difficulty Test**

No	IK	Kriteria
1	0.52	Sedang
2	0.64	Sedang
3	0.15	Sukar
4	0.18	Sukar
5	0.62	Sedang
6	0.51	Sedang
7	0.47	Sedang
8	0.34	Sedang
9	0.54	Sedang
10	0.65	Sedang

### **Distinguishing Power**

The following discriminatory abilities were obtained using the SPSS 25.0 program for Windows, based on the results of the discriminatory ability calculations in (Appendix 14) taking into account the previously determined criteria: an index  $\leq 0.00$  is classified as very poor, an index  $< 0.00$  is classified as poor, an index  $< 0.20$  is classified as sufficient, an index  $< 0.40$  is classified as good, and an index  $< 0.70$  is classified as very good.

**Table 3. Level of Difficulty**

No	IK	Kriteria
1	0.452	Baik
2	0.531	Baik
3	0.688	Baik
4	0.619	Baik
5	0.408	Baik
6	0.412	Baik
7	0.310	Cukup
8	0.344	Cukup
9	0.626	Baik
10	0.476	Baik

After conducting four trials of the measuring instrument – validity, reliability, level of difficulty, and discrimination – the researcher selected five questions – numbers 1, 2, 5, 9, and 10 – that met the requirements of the measuring instrument for both pre- and post-tests.

### **Observation Instrument Results**

The conceptual understanding of children in the sample, as measured through classroom observations using the Puzzle-Assisted Discovery Learning Model, ranged from 58 to 100. The mean score was 73.26.

**Table 4. Table of Student Observation Results**

No	$X_i$	$f_i$	Average
1	58	4	
2	63	3	
3	67	5	
4	71	5	

5	77	8	<b>73.26</b>
6	81	6	
7	88	1	
8	90	1	
9	100	1	

## Data Analysis Results

Normality testing is carried out as an initial step in evaluating hypotheses in data analysis.

### Data Analysis Prerequisite Test

#### Normality Test

To determine whether all variables in our study had a normal distribution, we conducted a normality test. The data normality test in this study was conducted using the Shaoiro-Wilk test. Data are considered to have a normal distribution if the sig value is greater than 0.05; conversely, data do not have a normal distribution if the sig value is less than 0.05. Appendix 16 contains the results of the normality test calculations, which are displayed in Table 4.6.

**Table 5. Normality Test**

KELAS		Tests of Normality					
		Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
HASIL		Statistic	df	Sig.	Statistic	df	Sig.
	Observasi Eksperimen	0.149	34	0.054	0.948	34	<b>0.108</b>
	Post Tes Eksperimen	0.158	34	0.030	0.941	34	<b>0.064</b>

a. Lilliefors Significance Correction

It can be concluded that the data follows a normal distribution based on the data shown above, because the significance value of the experimental class observations and the experimental class post-test is greater than 0.05.

## Hypothesis Testing

After ensuring that the data follows a normal and homogeneous distribution (prerequisite test), the next step is to test the hypothesis.

### Regression Analysis Results

#### Simple Regression Equation

The purpose of using a simple regression equation is to investigate the impact or relationship between two variables. The impact of the learning model on students'

conceptual knowledge was examined in this study using two simple regression tests, as shown in (Appendix 17) and Table 4.7 below.

**Table 6. Simple Linear Regression Test**

		Coefficients <sup>a</sup>				
		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	T	Sig.
1	(Constant)	32.472	10.127		3.207	0.003
	OBSERVASI_EKSPERIMEN	0.713	0.137	0.677	5.202	0.000

a. Dependent Variable: POST\_EKSPERIMEN

Based on the initial data analysis, the regression equation was obtained with a value of 32.472 and  $b_1$  of 0.713.

$$\hat{Y} = 32.472 + 0.713X_1$$

Both variables have a positive influence, as shown by the positive regression coefficient  $b_1 = 0.713$  in this equation.

1) Regression Linearity Test

**Table 7. Linearity Test**

		ANOVA Table					
			Sum of Squares	df	Mean Square	F	Sig.
POST_EKSPERIMEN *	Between (Combined)		2071.850	8	258.981	4.543	0.002
OBSERVASI_EKSPERIMEN	Groups	Linearity	1602.452	1	1602.452	28.109	0.000
		Deviation from Linearity	469.399	7	67.057	1.176	0.351
Within Groups			1425.208	25	57.008		
Total			3497.059	33			

The SPSS results show that the significant value of the deviation from linearity is 0.351 > 0.05, which indicates that the relationship is linear.

**Regression Significance Test**

**Table 8. Regression Significance Test**

**ANOVA<sup>a</sup>**

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1602.452	1	1602.452	27.065	.000 <sup>b</sup>
	Residual	1894.607	32	59.206		
	Total	3497.059	33			

a. Dependent Variable: POST\_EKSPERIMEN

b. Predictors: (Constant), OBSERVASI\_EKSPERIMEN

It can be concluded that the Discovery Learning Model, with the help of Puzzle media, influences students' conceptual understanding, as indicated by the significance level of  $0.000 < 0.05$  obtained from the ANOVA table calculation.

### Coefficient of Determination

**Table 9. R<sup>2</sup> Test Results**

**Model Summary**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.677 <sup>a</sup>	0.458	0.441	7.695

a. Predictors: (Constant), OBSERVASI\_EKSPERIMEN

The determination test produced an R value of 0.677 and a R value of 0.677. *bcfafe* is 0.458, based on the results of data analysis using SPSS. Students' conceptual understanding is influenced by the Puzzle-Assisted Discovery Learning paradigm by 45.8%, based on SPSS data processing and KP calculation =  $0.458 \times 100\% = 45.8\%$ .

### Research Discussion

Using a quasi-experimental approach, this study was conducted at SMP Negeri 1 Namorambe. The purpose of this study was to determine the extent to which seventh-grade students' conceptual understanding of fractions changed after using the discovery learning paradigm with puzzle media (Gulo, 2022). The population of this study included all seventh-grade students, with 34 students from class VII-1 as the sample. The research activities began in July 2025 with instrument validation by teachers or lecturers, testing, implementation of learning activities, and administration of the post-test to the experimental class (Ana, 2018). Class VIII-1 was used to test the instrument, and 29 students were randomly selected using cluster sampling. Only five of the ten questions were considered valid, reliable, challenging enough, and discriminatory to be included in the pretest and posttest (Batubara, 2020).

Afterward, the experimental class used a discovery learning model with puzzles as the medium to implement the learning. They then participated in observation activities and were tested afterward. The post-test results showed that students had an average score of 84.70 in their conceptual understanding. The post-test data were first analyzed using normality and linearity tests before the hypotheses were tested. Furthermore, the following equation was generated through a basic regression analysis conducted in SPSS :

$$\hat{Y} = 32.472 + 0.713X_1$$

This equation shows that the regression coefficient (b) is positive with a value of 0.713. This indicates a linear relationship between the two variables and suggests that the use of

puzzle media to support the discovery learning paradigm can improve learning outcomes in the cognitive aspect (Prasasti, Koeswanti, & Giarti, 2019). Consequently, the use of puzzle media together with the discovery learning paradigm has an effect size of 0.713, indicating that it improves students' conceptual knowledge. This finding supports the working theory of this study (Amelia & Sukma, 2021). In accordance with other studies, this study shows that the discovery learning paradigm has an influence on students' conceptual understanding and can significantly improve it (Hidayat & Sujarwo, 2022).

## CONCLUSION

In seventh-grade students at SMP Negeri 1 Namorambe, researchers examined how the use of a discovery learning model with puzzles influenced students' understanding of fractions. They found that this significantly improved their understanding of the concept. Hypothesis testing results confirmed this, as the significance value obtained was lower than the established threshold.

Furthermore, students were able to better understand fraction concepts and become more active learners thanks to the use of this learning method. Students' conceptual knowledge increased by 37.4% with the use of puzzles in the Discovery Learning approach.

## Suggestion

Researchers have proposed these suggestions based on the study findings:

1. To improve students' understanding of the subject matter and make the learning process more interesting, teachers are advised to use various learning strategies, such as Discovery Learning with puzzle media.
2. To understand the lesson material better, students are encouraged to actively participate in learning activities.
3. To broaden the scope and depth of findings, future researchers are encouraged to conduct similar studies using other learning materials or media.

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