Mastery of Mathematical Concepts and Problem-Solving Abilities Through Structured Assignment Methods in Junior High School Students

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Abstract: *This study aims to describe the influence of the structured assignment method on the mastery of concepts and mathematical problem-solving skills. The method used is an experimental method with the analysis technique used is Manova One Path. The sample in this study is a sample of 72 students at State Junior High Schools in the city of Tangerang. From the results of the analysis, it was obtained: (1) there was an influence of the structured assignment method on the mastery of the concept and the ability to solve mathematical problems in a multivariate manner as evidenced by the value of sig = 0.000 < 0.05 (2) there was an influence of the structured assignment method on the mastery of mathematical concepts univariate as evidenced by the value of sig = 0.006 < 0.05 (3) there was an influence of the structured assignment method on the ability to solve mathematical problems with It is proven that sig = 0.002 < 0.05. To improve the mastery of mathematical concepts and problem-solving skills, teachers should not only use conventional or teacher-centered learning methods but are expected to be able to use learning models that involve students actively learning, including assignment methods that can involve students actively in meaningful learning activities through problem-solving.*

Key Words: Structured assignment method; mastery of concepts; mathematical problem-solving skills; junior high school students

Introduction

Mathematics is an efficient tool in the development of knowledge (Krisnadi, 2022; Wangge, 2020). Mathematics is needed by every field of science, even more so in the development of science (Jannah & Hayati, 2024). Mathematics consists of interrelated symbols that are needed as a language for other sciences that symbolize a series of meanings that are intended to be conveyed, such as patterns and structures, changes and spaces, so informally it can be referred to as the science of numbers and numbers (Duha & Harefa, 2024; Yuntaro & Yudhanegara, 2024). On the other hand, artificial mathematical symbols only have meaning after a meaning is given (Agustina, 2024). The purpose of learning mathematics is to improve the understanding of mathematical concepts and problem-solving skills (Indirwan et al., 2021).

Conceptual understanding is the ability to obtain abstract ideas and classify objects into one term, the term is then added to examples and non-examples (Hayati & Marlina, 2021; Yani et al., 2022). Indicators of the ability to understand mathematical concepts are: 1). Repeat the concept, 2). Classify objects according to certain characteristics, 3). Provide examples and non-examples of concepts, 4). Presentation of concepts in mathematics that are different presentations, 5). Development of necessary or sufficient conditions for the

concept, 6). Access to the use and selection of procedures or functions, and 7). Applying algorithms (Terapulina & Kartika, D. 2024).

Other objectives in mathematics learning mathematical problem-solving skills (Hasbullah, 2019). Mathematical problem solving is an effort made in finding mathematical solutions using concepts or methods mastered by students (Ulpah et al., 2024). Indicators of problem-solving ability are students who are able to understand problems, develop a solution plan, implement the plan, and recheck

In fact, the mathematics learning process in schools has not been directed to an understanding of mathematical concepts and optimal problem solving. This is shown by the low knowledge of the concept. (Sengkey et al., 2023). In addition, the ability to solve mathematics is also still low. This is based on the results of the research, that the ability to understand the problem was 49.41%, the ability to prepare a problem plan was 34.44%, the ability to implement the problem plan was 42.14% and the ability of students to re-examine the problem was 4.24% (Utami & Wutsqa, 2017)

Many factors cause this to be low, namely teachers have not actively involved students in learning with discussion activities and group work, so students have not been able to construct and explore their thoughts in learning. External factors come from the methods or strategies used in learning (Diana et al., 2024). One of the alternative methods used in learning is the structured learning method. The emphasis on the assignment learning method is the assignment given by the teacher in achieving the maximum student learning process inside, outside the classroom, and as long as it is in the school environment. (Sardiman, 2020)

Learning by giving structured tasks is expected to stimulate students' thinking skills creatively, and they can train themselves because they often do assignments. In addition, giving structured assignments, can foster an effective and fun learning process and can improve the mastery of concepts and mathematical problem-solving skills.

Method

This research was carried out in Tangerang City. The population in this study is State Junior High School students in Tangerang City. For sampling in this study, two classes were taken randomly. The first class was 36 students as an experimental group. The second class, which is as many as 36 students as the control group. In sampling, the researcher took a multi-stage random sampling technique. This study uses a quasi-experimental research method. The first class is treated with a pre-learning structured assignment learning method. Then the second class was given the treatment of the learning method of post-learning assignment

Table 1. Research design

Structured Assignment Learning Method (A)			
Pre Learning (A1)		Post-Learning (A2)	
Y1	Y2	Y1	Y2
A1Y1	A1Y2	A2Y1	A2Y2

Information:

Y1= Understanding of Mathematical Concepts

Y2= Math Problem Solving Ability

The data collection technique in this study uses a test method to see the understanding of concepts and problem-solving skills. The normality test used was the Kolmogorov Smirnov analysis and the variance-covarians homogeneity test was carried out using Box's Test analysis. The hypothesis in the study was tested using the MANOVA statistical test. All tests are carried out using the SPSS program.

Results and Discussion

This study generally aims to obtain a more complete picture of the influence of structured assignment learning methods on the understanding of concepts and mathematical problem-solving abilities in Multivariate and Univariate. Results Testing The hypothesis of this study uses the multivariate analysis of variance technique with the help of SPSS. The test results are:

Table 2. Multivariate Test

Effect		Value	F	Hypothesis df	Error df	Sig.
Intercept	Pillai's Trace	.990	3414.586[b]	2.000	69.000	.000
	Wilks' Lambda	.010	3414.586[b]	2.000	69.000	.000
	Hotelling's Trace	98.973	3414.586[b]	2.000	69.000	.000
	Roy's Largest Root	98.973	3414.586[b]	2.000	69.000	.000
A	Pillai's Trace	.208	9.063[b]	2.000	69.000	.000
	Wilks' Lambda	.792	9.063[b]	2.000	69.000	.000
	Hotelling's Trace	.263	9.063[b]	2.000	69.000	.000
	Roy's Largest Root	.263	9.063[b]	2.000	69.000	.000
a. Design: Intercept + A						
b. Exact statistic						

Table 3: Test of Between-Subjects Effects

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	Understanding Concepts	1168.056[a]	1	1168.056	8.208	.006
	Math Problem-Solving Skills	1020.014[b]	1	1020.014	10.711	.002
Intercept	Understanding Concepts	366938.889	1	366938.889	2578.614	.000
	Math Problem-Solving Skills	432605.014	1	432605.014	4542.826	.000
A	Understanding Concepts	1168.056	1	1168.056	8.208	.006
	Math Problem-Solving Skills	1020.014	1	1020.014	10.711	.002
Error	Understanding Concepts	9961.056	70	142.301		
	Math Problem-Solving Skills	6665.972	70	95.228		
Total	Understanding Concepts	378068.000	72			
	Math Problem-Solving Skills	440291.000	72			
Corrected Total	Understanding Concepts	11129.111	71			
	Math Problem-Solving Skills	7685.986	71			
a. R Squared = .105 (Adjusted R Squared = .092)						
b. R Squared = .133 (Adjusted R Squared = .120)						

Testing the influence of the structured assignment learning method on the understanding of concepts and mathematical problem-solving skills together using the

multivariate test in table 2. obtained the result F = 9.063 with sig = 0.000 < 0.05 means H_o rejected.

There are four statistical tests, namely Pillai's *Trace, Wilk's lambda, Hotelling's Trace, and Roy Largest Root*. Based on the values of the four statistical tests in table 2. The intercept column value in the Pillai's Trace test is 0.990 indicating a significant influence because it has a value close to 1.

Meanwhile, in the Wilk's lambda test, the value value is 0.010. The smaller the value on the Wilk's Lambda test or close to zero, indicating a significant influence on the structured assignment learning method or a significant difference in the data group in the study, so that with the Wilk's Lambda test score of 0.010 in this study, it can be concluded that there is a significant influence of the structured assignment learning method on the understanding of concepts and mathematical problem-solving skills in both data groups.

The Hotelling Trace value in the study was 98.973 and the Roy's Largest Root value was 98.973. This shows that the value of Roy's Largest Root is the same as Hotelling's trace, so there is a significant influence of the structured assignment learning method on the understanding of concepts and mathematical problem-solving ability.

In column A on the significance number tested with the Pillai's Trace test procedure = 0.000, and Roy Largest Root = 0.000. From the four tests, the significance value is below 0.05 (sig < 0.05), then H0 is rejected and it can be concluded that there is a significant influence of the structured assignment learning method on the understanding of concepts and mathematical problem-solving skills .

While the test of the influence of the structured assignment learning method on the understanding of concepts and mathematical problem-solving abilities in univariate manner is shown in the Test of Between-Subjects Effects table, for the structured assignment learning method on concept understanding, the value of F = 8.208 with a sig value = 0.006 < 0.05 was obtained, indicating that the structured assignment learning method has a significant influenceto the understanding of mathematical concepts. This result is in accordance with previous research showing that there is an influence of the assignment method with the ability to understand mathematical concepts (Nurhayati et al., 2023; Pradnyani, 2023). In addition, the structured assignment method has an impact: (1) It can further deepen the comprehension ability of students in the subjects that have been studied; (2) Able to train the students' abilities in the direction of learning that is carried out independently; (3) Students have the ability to divide their free time to complete assignments from teachers; (4) Train the ability of students to find their own compatible ways to complete the task; (5) Providing a lot of proficiency in the school environment through various activities outside of classroom hours (Kasmir, 2021).

Meanwhile, the structured assignment learning method for mathematical problem-solving ability obtained a value of F = 10.711 with sig = 0.002, 0.05. This result is in accordance with previous research showing that there is an influence of the assignment method with mathematical problem-solving ability (Sari & Rusdi, 2023; Septiani et al., 2023). In addition, the structured assignment method has a relationship with the ability to solve problems ytiu: (1) It can further stimulate students' ability to learn individually or in groups, so that it will

affect the growth and development of students' motivation to learn; (2) It can train the development of students' independence outside the supervision of teachers, because homework is given to students so that they absorb knowledge and information both through the Internet and in group discussions; (3) Fostering the students' sense of responsibility and discipline for the teacher's duties, so students have the responsibility to complete the teacher's duties on time; (4) It can increase students' creativity from the assigned tasks, so that students are able to develop ways and mindsets in expressing opinions and ideas to solve the problems faced (Suparti, 2014).

Conclusion

Based on the results of the study, it can be concluded that the structured assignment learning method has a significant influence on the understanding of concepts and mathematical problem-solving abilities both multivariate and univariate. This indicates that to improve the understanding of concepts and mathematical problem-solving skills in junior high school students can be done by using the structured assignment method.

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