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The Influence of Cognitive Psychology on Student Responses in Mathematics Learning

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ABSTRAK

Terdapat kesenjangan yang signifikan antara teori psikologi kognitif dan praktik pembelajaran di banyak lembaga pendidikan. Akibatnya, banyak siswa tidak sepenuhnya mendapatkan manfaat dari pendekatan yang dirancang untuk meningkatkan pemahaman dan retensi. Penelitian ini bertujuan untuk mengetahui pengaruh psikologi kognitif terhadap respon siswa terhadap pembelajaran matematika. Pendekatan penelitian yang digunakan adalah pendekatan kuantitatif dengan metodologi komparatif. Dalam penelitian ini, teknik random sampling dipilih untuk menentukan sampel. Sampel penelitian terdiri dari 120 siswa kelas VII dari dua sekolah. Teknik pengambilan sampel yang digunakan adalah random sampling. Sampel penelitian ini diambil dari empat kelas VII, dengan total subjek penelitian sebanyak 30 siswa. Data dikumpulkan menggunakan instrumen berupa angket psikologi kognitif dan angket respon siswa terhadap pembelajaran matematika yang diukur dengan skala Likert. Analisis data kuantitatif dilakukan menggunakan perangkat lunak pengolah data dengan uji perbandingan dan uji pengaruh. Hasil penelitian menunjukkan bahwa terdapat perbedaan signifikan dalam aspek psikologi kognitif antara kedua kelompok yang diteliti. Selain itu, hasil penelitian juga mengindikasikan bahwa psikologi kognitif memiliki pengaruh yang signifikan terhadap respon siswa terhadap pembelajaran matematika. Temuan ini memberikan implikasi penting bagi pendidik dan pembuat kebijakan pendidikan. Dengan memahami pengaruh psikologi kognitif terhadap respon siswa, pendidik dapat mengembangkan strategi pengajaran yang lebih efektif yang dapat meningkatkan motivasi dan prestasi belajar siswa.

ABSTRACT

There is a significant gap between cognitive psychology theory and learning practices in many educational institutions. As a result, many students do not fully benefit from approaches designed to improve comprehension and retention. This research aims to analyze the influence of cognitive psychology on students' responses to learning mathematics. The research approach used is a quantitative approach with comparative methodology. In this research, a purposive sampling technique was chosen to random sampling. The research sample consisted of 120 class VII students from two schools. The sampling technique used was random sampling. This research sample was taken from four class VII, with a total of 30 research subjects. Data was collected using instruments in the form of a cognitive psychology questionnaire and a questionnaire on student responses to mathematics learning as measured by a Likert scale. Quantitative data analysis was carried out using data processing software with comparison tests and influence tests. The research results showed that there were significant differences in aspects of cognitive psychology between the two groups studied. Apart from that, the research results also indicate that cognitive psychology has a significant influence on students' responses to mathematics learning. By understanding the influence of cognitive psychology on student responses, educators can develop more effective teaching strategies that can increase student motivation and learning achievement.

1. INTRODUCTION

Learning is a dynamic process in which individuals acquire, assimilate, and apply knowledge, skills, and attitudes through experience, study, or instruction (Crisvin. et al., 2023; Nurmaliah, 2020; Rahmatika et al., 2021). This process is not only limited to formal environments such as schools and universities, but

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also occurs in various informal contexts and throughout a person's life (Ahsanulkhaq, 2019; Dini et al., 2020). Learning effectiveness is influenced by various factors including motivation, teaching methods, learning environment, and social interaction (Nisa & Sujarwo, 2020; Tegeh et al., 2019; Tri Pudji Astuti, 2019) . With the right approach and adequate support, learning can be a powerful tool for personal and professional growth, encouraging innovation, and adaptation to change in an ever-evolving society. Cognitive psychology is a branch of psychology that studies the mental processes involved in perception, thinking, memory and problem solving (Arief et al., 2022; Nisa & Suyadi, 2020). This field focuses on how individuals understand, analyze, and interpret information from their environment, as well as how they make decisions and solve problems based on that information. Using experimental methods, cognitive psychologists try to uncover the mechanisms behind brain function, such as how memory works, how attention is directed, and how language is processed (Nisa & Suyadi, 2020; Sulistyaningtyas & Fauziah, 2019) . Knowledge from cognitive psychology is applied in a variety of fields, including education, therapy, and technology development, to improve learning effectiveness, human-machine interactions, and overall mental well-being.

Student cognitive psychology studies how mental processes such as attention, memory, thinking, and problem solving influence the way students learn and interact with information (Magdalena et al., 2023; Wasono, 2022). The main focus in this field is understanding how students process new information, how they integrate it with existing knowledge, and how they use effective learning strategies (Supriyanto et al., 2022; Triwardhani et al., 2020). By understanding these cognitive mechanisms, educators can design teaching methods that are more appropriate to the way students' brains work, thereby increasing the effectiveness of learning and helping students reach their optimal academic potential.

As a learner, the student's response to the learning process is greatly influenced by the cognitive psychology approach. Learners who understand how their minds work tend to be more able to organize effective learning strategies, such as managing time well, using mnemonics to remember information, and applying critical thinking in solving problems (Nurhadi, 2020; Swirski et al., 2018; Wulandari et al., 2021). With the support of teachers who apply cognitive psychology principles in teaching methods, students can more easily absorb lesson material, retain information in the long term, and feel better. confident in facing academic challenges (Crawley et al., 2019; Sofyan et al., 2019). Learning experiences that are interactive and relevant to everyday life also increase student motivation and engagement, so they are more enthusiastic about achieving their educational goals.

There is a significant gap between cognitive psychology theory and learning practices in many educational institutions (Zysberg & Schwabsky, 2021). While previous research has shown the effectiveness of cognitive-based strategies such as active learning, collaborative problem solving, and the use of interactive technologies, their implementation in the classroom is often limited by rigid curricula, limited resources, and lack of teacher training (Ananda & Hudaidah, 2021). As a result, many students do not fully benefit from approaches designed to improve comprehension and retention. To bridge this gap, this research update collaboration between researchers, educators, and policymakers is needed to design more flexible curricula and provide adequate training for teachers so that cognitive psychology principles can be effectively integrated into everyday instructional practices.

Novelty in the learning context refers to the introduction of new and innovative elements that can trigger student interest and motivation, as well as increase the effectiveness of the learning process. Applications of novelty can take the form of using the latest technology, unconventional teaching approaches, or integrating challenging creative projects. By introducing an element of novelty, students are more likely to be actively engaged in learning, develop greater curiosity, and strengthen critical thinking skills. Research shows that learning experiences that offer elements of novelty not only make learning more interesting, but also help students remember and understand the material more deeply, because the brain tends to pay more attention to and process information that is considered new and interesting.

This research is in line with research conducted which discusses cognitive psychology (Deveney, 2021). However, this study did not test two schools as was done in this study. Cognitive psychology enables a deep understanding of how humans process information, make decisions, and solve problems effectively. Through cognitive psychology, we can develop strategies and techniques to improve cognitive performance, overcome mental disorders, and improve overall quality of life. Based on this background, this study aims to analyze the effect of the application of cognitive psychology principles on improving the quality of learning and students' academic outcomes.

2. METHOD

This research uses a quantitative approach with a comparative methodology. A comparative type quantitative approach is usually used to compare two or more variables or groups in a study (Hamdani et

al., 2017; Rahayu et al., 2021). In the context of this research, a comparative approach is useful for exploring differences or correlations between certain variables. This method often involves collecting number-based data and using statistical analysis to test hypotheses or identify patterns that may exist in the data. The instruments in this study used student cognitive psychology questionnaires and mathematics learning questionnaires . Where the questionnaire used consists of 36 valid statement items on this instrument using a Likert scale. The scale consists of 4 points with a value of very good being 4, good being 3, not good being 2, very bad being 1. Each statement is a representative of each indicator of independent character and understanding of concepts. The focus of this research is on 36 indicators. Student cognitive psychology instrument grid is show in Table 1.

Table 1. Student Cognitive Psychology Instrument Grid

Variables	Indicators	Total Items
Cognitive	Attention	1,2,3 ,4,5
Psychology	Memory	6,7,8,9,10
	Problem Solving	11,12,13,14
	Critical Thinking	15,16,17,18,19
	Decision Making	20,21,22,23,24
	Information Processing	25,26,27,28,29
	Metacognition	30,31,32,33
	Creativity	34,35,36
Total		**36**

This research uses a Likert scale which consists of 4 categories, so there are intervals in each category, and the intervals in each category. The categories of student responses to mathematics learning are shown in Table 2.

Table 2. Student Response Instrument Grid to Mathematics Learning

Variables	Indicators	Total Items
Student Response	Response	1,2,3 ,4
	Relevance	5,6,7,8,9
	Attention	10,11,12,13
	Satisfaction	14,15,16,17
	Self-confident	18,19,20,21
Total		**21**

After explaining the grid of students' cognitive psychology indicator instruments, measurements were then carried out using descriptive statistical tests. Category of student cognitive psychology is show in Table 3.

Table 3. Students' Cognitive Psychology Categories

Categories	Interval of variables	
	Student Generic Skills	Student Respondent
Very not good	36.0 – 63.0	21.0-36.75
Not good	63.1 – 90.0	36.85-52.75
Good	90.1 – 117.0	52.85-68.25
Not Good	117.1 – 144.0	68.35-84.0

The population of this study was 120 students from two schools, namely SMPN 22 Batanghari and SMP IT Aulia Muara Bulian. The sampling technique is random sampling. The sample for this research came from class VII, totaling 4 classes, with 30 students being the subjects studied. The reason for selecting research subjects from VII is because the school has done a lot of mathematics learning so that students' cognitive psychology variables can be identified in mathematics learning (Meganingtyas et al., 2019; Rizkiwati et al., 2022).

This research began with distributing questionnaires, followed by quantitative data analysis and identifying findings for further research. At the data collection stage, 120 students in two schools were asked to fill out a questionnaire. Analyzing data using SPSS software using descriptive and inferential statistical tests. First of all, descriptive statistics are used to provide an overview of students' cognitive

psychology. Next, assumption tests are carried out such as normality tests, homogeneity tests and linearity tests. The normality test is used to evaluate whether the data follows a normal distribution (Febriyanti et al., 2019). The homogeneity test is used to check whether the variance between two different data groups is similar (Miarsyah et al., 2018). The linearity test is used to assess the linear relationship between two variables (Diawati et al., 2020). Next, test the hypothesis using the t test and regression test. The t test is used to compare two groups of data, while the regression test is used to evaluate the relationship between two variables. The data was then analyzed using the SPSS program to calculate frequency, average and standard deviation. The data collection process was carried out by selecting students according to research categories and giving questionnaires about students' cognitive psychology. The SPSS application was used to analyze survey data. Figure 1 shows the data collection procedures for this study.

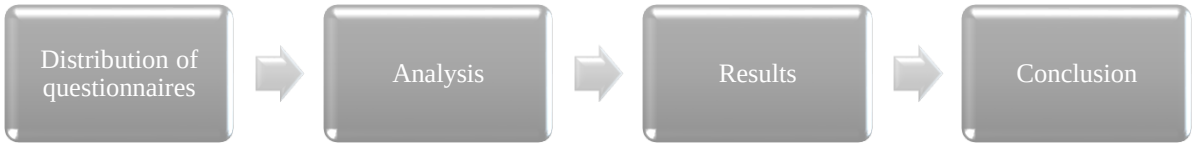

Figure 1. Research Procedure

The research procedure described in Figure 1 has four main stages. The first step in this study is the distribution of questionnaires to respondents. The purpose of the questionnaire is to collect data from students, especially regarding their cognitive psychology. This questionnaire was distributed to a group of students who had been selected based on the research category.

After the data was collected through the questionnaire, the data was analyzed using SPSS software. Various statistical tests, both descriptive and inferential, were used to understand the survey results, including testing for normality, homogeneity, and linearity of the data. This ensures that the data meets the basic assumptions of statistics before proceeding to further hypothesis testing.The results of this analysis are then presented, which include various descriptive statistics such as frequency, mean, and standard deviation. The t-test and regression are used to begin the relationship between two different variables, based on the data collected. The last step is to draw conclusions based on the results of the analysis. This conclusion includes the main findings of the study based on the statistical results that have been analyzed. This process provides insight into the influence of the variables studied on students' cognitive abilities.

3. RESULT AND DISCUSSION

Result

Below are presented the results of descriptive cognitive psychology tests of students in mathematics learning as show in Table 4.

Table 4. Test Description of Students' Cognitive Psychology

Student response		Intervals	F	Percentage	Categories	Mean	Median	Min	Max
SMPN 22 Batanghari	VII A	36.0 – 63.1	0	0%	Very not good	3.20	3.00	2.00	4.00
		63.1 – 90.0	2	10%	Not good				
		90.1 – 117.0	11	55%	Good				
		117.1 – 144.0	7	35%	Very good				
	VII B	36.0 – 63.1	0	0%	Very not good	3.10	3.00	2.00	4.00
		63.1 – 90.0	4	20%	Not good				
		90.1 – 117.0	9	45%	Good				
		117.1 – 144.0	7	35%	Very good				

Student response		Intervals	F	Percentage	Categories	Mean	Median	Min	Max
Aulia Muara Bulian IT Middle School	VII A	36.0 – 63.1	1	5%	Very not good	2.85	3.00	1.00	4.00
		63.1 – 90.0	2	10%	Not good				
		90.1 – 117.0	9	45%	Good				
		117.1 – 144.0	8	40%	Very good				
	VII B	36.0 – 63.1	2	0%	Very not good	2.75	3.00	1.00	4.00
		63.1 – 90.0	3	15%	Not good				
		90.1 – 117.0	8	40%	Good				
		117.1 – 144.0	7	45%	Very good				

Based on the results of Table 4, it can be said that SMPN 22 Batanghari and SMP IT Aulia Muara Bulian classes VII A, VII B are superior in the good category. A description of descriptive statistical tests on student responses is presented in Table 5.

Table 5. Test Description of Students' Cognitive Psychology

Student response		Intervals	F	Percentage	Categories	Mean	Median	Min	Max
SMPN 22 Batanghari	VII A	21.0-36.75	1	5%	Very not good	2.85	3.00	1.00	4.00
		36.85-52.75	2	10%	Not good				
		52.85-68.25	9	45%	Good				
		68.35-84.0	8	40%	Very good				
	VII B	21.0-36.75	2	0%	Very not good	2.75	3.00	1.00	4.00
		36.85-52.75	3	15%	Not good				
		52.85-68.25	8	40%	Good				
		68.35-84.0	7	45%	Very good				
Aulia Muara Bulian IT Middle School	VII A	21.0-36.75	1	5%	Very not good	3.15	3.00	1.00	4.00
		36.85-52.75	4	20%	Not good				
		52.85-68.25	8	40%	Good				
		68.35-84.0	7	35%	Very good				
	VII B	21.0-36.75	2	10%	Very not good	3.25	3.00	1.00	4.00
		36.85-52.75	3	15%	Not good				
		52.85-68.25	9	45%	Good				
		68.35-84.0	6	30%	Very good				

Based on the results show in Table 5, it can be said that SMPN 22 Batanghari and SMP IT Aulia Muara Bulian classes VII A, VII B are superior in the good category. A description of the normality test is presented in Table 6.

Table 6. Student Cognitive Psychology Normality Test and Student Responses to Mathematics Learning

Variables	School	Kolmogorov-Smirnov			Shapiro-Wilk		
		Statistics	Df	Sig.	Statistics	Df	Sig.
Cognitive Psychology	SMPN 22 Batanghari	0.127	60	0.200	0.877	60	0.625
	Aulia Muara Bulian IT Middle School	0.139	60	0.200	0.864	60	0.273
Student Response	SMPN 22 Batanghari	0.115	60	0.200	0.845	60	0.362
	Aulia Muara Bulian IT Middle School	0.087	60	0.200	0.873	60	0.446

Based on the results of Table 6, it can be concluded that the data is normally distributed, the normality test is obtained with the Kolmogorov-Smirnov test, the significance value is > 0.05. Table 7 shows the linearity test of students' cognitive psychology and students' responses to mathematics learning.

Table 7. Linearity Test of Students' Cognitive Psychology and Student Responses to Mathematics Learning

Variables	School	Sig.
Cognitive Psychology	SMPN 22 Batanghari	0.069
	Aulia Muara Bulian IT Middle School	0.066
Student Response	SMPN 22 Batanghari	0.068
	Aulia Muara Bulian IT Middle School	0.065

Based on the results of Table 7, it can be concluded that the data is linear, the linear test is obtained with the Kolmogorov-Smirnov test, the significance value is > 0.05. Table 8 presents a test of students' cognitive psychological homogeneity and students' responses to mathematics learning.

Table 8. Homogeneity Test of Student Cognitive Psychology and Student Responses to Mathematics Learning

Variables	School	Sig.
Cognitive Psychology	SMPN 22 Batanghari	0.076
	Aulia Muara Bulian IT Middle School	0.074
Student Response	SMPN 22 Batanghari	0.077
	Aulia Muara Bulian IT Middle School	0.075

Based on the results of Table 8 it can be concluded that the data is homogeneous, the homogeneity test was obtained using the Kolmogorov-Smirnov test with a significance value of > 0.05. Table 9 show students' cognitive psychology t-test and students' responses to mathematics learning.

Table 9. Student Cognitive Psychology T Test and Student Responses to Mathematics Learning

Variables	School	Q	Df	Sig. (2-tailed)	Mean Difference
Cognitive	SMPN 22 Batanghari	17.234	60	0.022	70.55354
Psychology	Aulia Muara Bulian IT Middle School	18.235	60	0.023	75.55634
Student	SMPN 22 Batanghari	15.454	60	0.024	65.55254
Response	Aulia Muara Bulian IT Middle School	16.321	60	0.025	60.51224

Based on Table 9, it can be interpreted that there is a comparison between students' cognitive psychology and students' responses at both schools as seen from the sig results. (2-tailed) smaller than 0.05. Table 10 show student cognitive psychology regression tests and student responses to mathematics learning.

Table 10. Regression Test of Student Cognitive Psychology and Student Responses to Mathematics Learning

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	14.745	1	16.725	0.949	0.022
Residual	266.374	119	15.584		
Total	**282.116**	**120**			

ANOVA regression test on student cognitive psychology and student responses. Base on Table 10 it can be concluded that students' cognitive psychology and students' responses influence each other. This is proven by sig. < of 0.005. So Table 11 is the results of the f Regression test with ANOVA from student cognitive psychology and student responses as follows:

Table 11. Student Cognitive Psychology Regression Test and Student Responses

R	R Square	Adjusted R Square	Std. Error of the Estimate
0.225	0.055	0.003	3.071 37

Regression test of students' cognitive psychological attitudes and students' responses to R was 0.225, R square 0.055, Adjusted R square 0.003, and Std. Estimation Error 3.07137. So the table below is the result. regression test on students' cognitive psychology and students' responses as show in Table 12.

Table 12. Student Cognitive Psychology Regression Test and Student Responses

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Cognitive Psychology >< Student Response	66.490	13.698		4.623	0.002

Base on Table 12, it was concluded that there was an influence between students' cognitive psychology and students' responses. This can be seen from the sig results (2-tailed) smaller than 0.05.

Discussion

Student cognitive psychology focuses on how students process information, develop understanding, and apply knowledge in the learning context. Research in this field explores various cognitive aspects such as attention, memory, problem solving, and critical thinking. By understanding these cognitive processes, educators can design more effective and adaptive teaching strategies, helping students to learn more efficiently and deeply. Can stimulate students' critical thinking abilities and problem solving skills, while mnemonic techniques can improve long-term memory abilities (Iman & Khaldun, 2017; Primayana, 2019; Wasono, 2022). Therefore, a deep understanding of cognitive psychology is very important in creating a learning environment that supports students' optimal intellectual development.

In this study, a series of assumption tests were conducted to meet the data requirements for statistical analysis. First, the normality test using Kolmogorov-Smirnov showed that the data were normally distributed, with a significance value greater than 0.05. This indicates that the distribution of cognitive psychology data and students' responses to mathematics learning does not deviate from the normal distribution. Furthermore, the linearity test also showed similar results, where the data was linear with a significance value> 0.05, which means that the relationship between cognitive psychology variables and student responses can be further analyzed. The homogeneity analysis test showed that the variances of the two variables were closely related, also with a significance value> 0.05, so that statistics such as t-tests and regressions could be performed.

The test results showed significant differences between the two schools in terms of cognitive psychology and students' responses to mathematics learning, as evidenced by the sig value (2-tailed)> 0.05. This indicates that different approaches in each school produce different effects in the development of students' cognitive abilities and how they respond to mathematics lessons. The regression test conducted strengthened this finding, showing that cognitive psychology significantly influences students' responses to mathematics learning. Thus, this study successfully demonstrates the importance of cognitive psychology aspects in influencing the way students respond to and learn mathematics, as well as the differences between learning approaches in different schools.

The implications of this research in the context of cognitive psychology and students' responses to mathematics learning highlight the importance of paying attention to individual cognitive aspects in designing effective teaching strategies. It was found that the use of learning models that emphasize problem solving increases their understanding of mathematical concepts and strengthens problem resolution abilities (Apriyantini et al., 2024; Hamdani et al., 2017; Juliawan et al., 2022). These results show that mathematics learning that focuses on understanding concepts, not just memorizing formulas, can trigger positive responses from students, increase learning motivation, and reduce the tendency towards mathematics anxiety (Amran et al., 2021; Mulyati & Evendi, 2020; Zulfa & Haryanto, 2021). Therefore, mathematics educators can utilize these findings in designing more engaging and meaningful learning experiences, which in turn can improve students' academic achievement and cognitive development in the context of mathematics learning.

The novelty of this study lies in its comprehensive approach in examining the relationship between cognitive psychology aspects and students' responses to mathematics learning. This study not only focuses on the effectiveness of the learning model, but also looks at how the model affects the development of students' critical thinking and problem-solving skills. In addition, this study emphasizes the importance of considering psychological factors in designing a mathematics curriculum that is more adaptive and in accordance with students' learning needs. By combining the concept of cognitive psychology in the context of mathematics learning, this study offers a new perspective that can enrich teaching practices and curriculum development in the field of mathematics education.

4. CONCLUSION

The conclusion of this study based on the results of the normality, linearity, and homogeneity tests, the research data is proven to meet the assumptions for further analysis. The normality test shows that the

data is normally distributed with a significance value of > 0.05, while the linearity test also shows that the data is linear with a significance value of > 0.05. The homogeneity test shows that the variance of the two variables is related, with a significance value of > 0.05. The results of the t-test show a significant difference between the two schools in terms of cognitive psychology and student responses to mathematics learning. In addition, the results of the regression test show that cognitive psychology influences student responses to mathematics learning.

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