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The Effect of Mathematical Logical Intelligence on Mathematical Problem Solving Ability through Contextual Approach

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Abstract

The purpose of this study was to prove that there is a correlation between mathematical logical intelligence and mathematical problem solving ability through a contextual approach and to prove that is a significant effect of mathematical logical intelligence on mathematical problem solving ability through a contextual approach. The sample used was 31 students of class VIII B MTs Tauhidiyah Sulang with the material used is polyhedron. The learning process in this study was based on lesson plans with a contextual approach, while the data were obtained through mathematical logical intelligence instruments and mathematical problem solving ability tests. After the data was collected and analyzed using two techniques, namely simple linear correlation and simple linear regression, the conclusions were: 1) There is a positive correlation and significant (r = 0.417) between mathematical logical intelligence and problem solving ability through a contextual approach. 2) There is a significant effect of mathematical logical intelligence on mathematical problem solving ability through a contextual approach of 17.4% which is explained by the regression line equation Y=3.360+0.265X, which means that the mathematical problem solving ability variable has a consistent value a 3.360 and it can be said that for every increase 1 unit of mathematical logical intelligence value increase 0.265 trought contextual approach.

Keywords: *Mathematical Logical Intelligence; Problem Solving Ability, Contextual Approach*

A. Introduction

Education has an important role for every individual, education plays a role in helping each individual, especially students from their nature to a much better human civilization (Sujana, 2019). By taking education, it can produce sustainable quality for future generations. As a country with a large population, Indonesia needs a large number of quality human resources to support development in Indonesia. For this reason, education is needed as one of the main parts of improving the quality of human resources (Kurniawan & Andriani, 2021). In an educational environment, mathematics is an important science to learn (Yudha, 2019). Mathematics has the meaning of a knowledge that is obtained from a person's ability to think with reason and reason. From this understanding it can be seen that mathematics must be thought of using logic and reason, this is needed to solve existing problems.

Problem solving abilities should be possessed by each student (Haryono, et al., 2021). This is in accordance with what was conveyed by NCTM, namely in mathematics there are five basic abilities that must be possessed by every student, one of which is problem solving skills. Saad & Ghani said that problem solving is an organized process and really needs to be done in order to get certain results from a problem that may not be obtained quickly (Asmal, 2020). When solving math problems, each student may have a different thought process. This difference is because each student has a different type of intelligence. Gardner states that everyone has at least nine intelligences, namely linguistic intelligence, logical-mathematical intelligence, visual-spatial intelligence, musical intelligence, kinesthetic intelligence, interpersonal intelligence, intrapersonal intelligence, naturalist intelligence, and existential intelligence (Hartanti, 2019). Intelligence that is closely related to mathematics is logical-mathematical intelligence. Mathematical logical intelligence is a person's intelligence related to the use of numbers, cause-effect relationships and problem solving (Sholeh et al., 2016). According to Gardner in solving mathematical problems requires students' mathematical logical intelligence, because mathematical logical intelligence is a person's ability to think logically. inductive and deductive, think to understand and analyze patterns, and solve problems (Asmal, 2020).

As a place of learning, schools must be able to find solutions to develop problem-solving skills based on the level of mathematical logical intelligence of each student (Sukardjo & Yusdiningtias, 2018). Teachers must be able to determine appropriate learning methods, strategies and models so that learning

objectives can be achieved (Agnesti & Amelia 2020). The teacher must also strive to improve students' reasoning abilities, one of which is by presenting a learning atmosphere that can improve students' mathematical problem solving abilities, namely by means of students being actively involved in the learning process and students are not just imitating or following without knowing the meaning. One of the learner-centered learning is the contextual approach (Fajriyah & Zanthy 2019). The contextual approach is an educational process that aims to help students learn material and relate it to the context of everyday life, namely to the context of their personal, social and cultural environment. In the contextual approach, the teacher brings real-world situations into the classroom and encourages students to make connections between knowledge and its application in their lives as members of their families and communities. With this concept, learning outcomes are expected to be more meaningful for students (Isharyadi, 2018).

The description above is in line with research conducted by Akhmad (2020) which shows that logical mathematical intelligence and visual spatial intelligence have an influence on geometric problem-solving abilities. In addition, research by Jubaidah (2017), where this research shows that there is an influence of contextual learning models assisted by Hand On Activity and independent learning on students' problem-solving abilities. Meanwhile, research by Pramesti and Oktalia (2021) shows that there is no effect of logical mathematical intelligence on student learning outcomes, and for the final conclusion, logical mathematical intelligence and spatial intelligence together do not affect student learning outcomes.

Based on the results of observations made by researchers at MTs Tauhidiyah Sulang by interviewing mathematics teachers at MTs Tauhidiyah, it can be seen that most students have not been able to use their mathematical logical intelligence well to solve mathematical problems, this is because in the learning strategies applied they still use strategic approaches conventional learning, which in learning is all focused and sourced from the teacher so that students in learning are less active and the material taught is less meaningful because the material studied is only abstract theory and is not related to real life, this has an impact on students' mathematical problem solving abilities which less able to develop. After making observations the authors conducted interviews with several students at MTs Tauhidiyah Sulang. The results of the interviews obtained by the author with the students were similar to the results of observations made on one of the mathematics teachers at MTs Tahudiyah Sulang, that is, most students were only able to solve questions that were similar to the examples of questions that had

been explained by the teacher, and they experienced difficulties when working on the questions. problem solving, students have not been able to properly analyze the mathematical problems given. The teacher must provide a detailed and gradual explanation of the material or problem-solving questions given. Based on the description above, the writer is interested in conducting research on "The Influence of Mathematical Logical Intelligence on Problem Solving Ability in Flat Sided Space Building Materials through a Contextual Approach." The research objectives are: 1) to prove that there is a relationship between mathematical logical intelligence and mathematical problem solving abilities through a contextual approach; 2) to prove that there is a significant influence of mathematical logical intelligence on mathematical problem solving abilities through a contextual approach.

B. Discussion

1. Mathematical Logical Intelligence

Intelligence is a hidden provision possessed by a person to make it easier for him to learn and produce optimal performance. Azwar defines intelligence as a person's ability to direct a thought and change actions that have been taken (Septiani 2020), while Gardner and Moran say that intelligence is a person's ability to process information by using his physical and psychological strength in carrying out an activity so that it is easy to complete it. (Suripatty, Nadiroh, & Nurani 2020) Howard Gardner, a psychologist from Harvard University put forward a theory of intelligence called multiple intelligences, that every child has at least nine intelligences, namely language intelligence (linguistics), logical mathematical intelligence (cognitive), drawing intelligence and space (visual-spatial), musical intelligence, movement intelligence (kinesthetic), social intelligence (interpersonal), self-aware (intrapersonal), natural intelligence, and existential intelligence. (Hofur 2020).

Intelligence that is closely related to mathematics is logical-mathematical intelligence. According to Prasetyo and Yeni, logical mathematical intelligence is a person's ability to process numbers, think logically to analyze problems, and analyze problems systematically. (Sholeh et al. 2016) According to Nelson logical mathematical intelligence is a person's ability to think deductively and inductively to know abstract patterns and relationships. Based on this opinion, it can be concluded that logical-mathematical intelligence is a person's ability to think based

on logical rules, be able to understand and analyze something related to numbers, and be able to solve problems with the ability to think logically and systematically..

Children who have high logical-mathematical intelligence tend to have certain characteristics, including someone who has logical-mathematical intelligence tends to think deductively, inductively, and rationally, so they like counting, asking questions, and experimenting (Yanti 2020). The indicators of mathematical logical intelligence according to Masykur and Fathani include the following: Likes activities related to numbers, sequences, measurements, and number patterns; able to arrange solutions logically and systematically; able to think inductively and deductively; easy to find a solution to a problem; Have an interest in analogies and syllogisms (Asmal 2020)

2. Mathematical Problem Solving Ability

Problem-solving ability as one of the main goals of learning mathematics, mathematics subjects at the primary and secondary education levels aim to enable students to be able to solve problems. Djamin Bondan said that if someone is given a problem and he is able to easily solve it, then it cannot be called a problem. (Febriyanti & Irawan 2017). Polya stated that problem solving ability is a person's ability to obtain a solution or way out of a goal that is not easy to achieve, Robert L. Solso said that problem solving is a way to find a way out of a specific problem with directed thinking. (Akbar et al. 2018). From the opinions expressed by some of these experts, it can be said that the ability to solve mathematical problems is a person's ability to determine a step or a good strategy to achieve a goal based on the correct rules. They are able to solve math problems by using their ability to think critically, creatively, and efficiently (Febriyanti and Irawan 2017).

Many factors can influence the development of students' problem solving abilities. One of them is from Siswono's opinion, he said there are several factors that influence an individual's problem solving abilities, including early experience, mathematical background, desire and motivation, problem structure (Alifia & Rakhmawati 2018). In solving a problem there are steps to go through, according to Polya in general there are four steps in solving a problem, namely understanding the problem and developing a problem-solving plan. carry out the problem-solving plan, check back.

3. Contextual Approach

The teacher must determine the right learning process to improve students' ability to solve problems, one of which is by learning that focuses on contextual problems (Afriana 2021), while the right strategy is used for contextual problems, namely the contextual approach. The contextual approach is a holistic learning process that has the goal of encouraging students to understand more deeply the material being studied by relating it to their daily life situations, so that students have knowledge and skills that are easy to apply from one problem to another (Majid 2017). The contextual approach involves students fully in the learning process by finding the material being studied and then connecting it with real world situations (Amanullah and Utami 2020). The contextual approach involves seven main components in effective learning namely constructivism, asking, finding, learning community, modeling, actual assessment, and reflection (Sanjaya 2011).

The contextual approach can be used in any curriculum and subject, as well as in any classroom situation. Approach this in a fairly easy class. In general, the steps for contextual learning are as follows: 1) develop the idea that learning will be more meaningful if students study independently and develop their own skills; 2) carry out inquiry activities (discoveries) as far as possible on all topics in the material; 3) develop students' curiosity through asking questions; 4) creating a learning community, by forming students from several groups; 5) one of the students with high ability is presented to reflect contextually on the material being studied; 6) at the end of the meeting, reflect with representatives of each group to conclude the material being studied; 7) when the teacher's learning process gives a real assessment to students, for example assessing the presentation process of students' work.

In this study, researchers used a quantitative approach, and the research method used was the experimental method, namely the method used to seek the influence of certain treatments under conditions controlled by the researcher. The research design used is a pre-experimental design, the type used is precisely a one-shot case study, where the treatment is given to a group without a control group, and then the results are observed by carrying out a posttest.

The data collection instruments used were questionnaires and description tests, for the data analysis techniques used were simple linear correlation analysis and simple linear regression analysis.

Before the instrument was tested, the instrument was tested for validity and reliability first with the results obtained as follows

Table 1. Questionnaire Trial Results

No	Validity	Reliability	Remarks
1	Valid	Reliabel	Used
2	Valid		Used
3	Valid		Used
4	Valid		Used
5	Valid		Used
6	Valid		Used
7	Invalid		Not used
8	Invalid		Not used
9	Valid		Used
10	Invalid		Not used
11	Invalid		Not used
12	Valid		Used
13	Valid		Used
14	Invalid		Not used
15	Valid		Used
16	Valid		Used
17	Valid		Used
18	Valid		Used
19	Valid		Used
20	Invalid		Not used

Based on the results of the validity and reliability tests using Excel, it can be concluded that out of 20 questionnaire items, there are 6 items that cannot be used for research because the results are invalid. Questionnaire items that cannot be used for research are questionnaire items 7, 8, 10, 11, 14, and 20.

Table 2. Test Results Problem

No	Validity	Reliability	Differences	Difficulty Index	Remarks
1	Invalid	Reliabel	Very Poor	Easy	Not used
2	Valid		Good	Currently	Used
3	Valid		Very good	Currently	Used
4	Valid		Good	Currently	Used

Based on the results of the validity, reliability, discriminating power and difficulty index tests using Excel, it can be concluded that out of 4 items there is 1 item that cannot be used for research because the results are invalid. Items that cannot be used for research are item 1, while items that can be used for research are item 2, 3, and 4.

Before testing the hypothesis analysis, the data obtained must be tested first which includes the normality test and linearity test, then the data is tested statistically by using simple linear correlation and simple linear regression.

4. Normality test

The data obtained must be tested whether a sample comes from a normally distributed population or not. Normality is tested on independent and dependent variables which include: Mathematical Logical Intelligence, contextual approach and Problem Solving Ability. On the basis of decision making, that is if the sig value <0.05 then the data distribution is not normal and if the sig value ≥0.05 then the data distribution is normal. Normality results for this research variable, using IBM SPSS Statistics 25 are presented as follows.

Table 3. Normality Test

One-Sample Kolmogorov-Smirnov Test

		Unstandardized Residual
N		31
Normal Parameters[a,b]	Mean	.0000000

	Std. Deviation	2.26390838
Most Extreme Differences	Absolute	.069
	Positive	.061
	Negative	-.069
Test Statistic		.069
Asymp. Sig. (2-tailed)		.200[c,d]

a. Test distribution is Normal.

b. Calculated from data.

c. Lilliefors Significance Correction.

d. This is a lower bound of the true significance.

From the SPSS results above, it shows that the significance value is greater than 0.05 (sig> 0.05), that is, with a sig value of 0.200> 0.05, Ho means that the research data is normally distributed.

Tabel 3 Uji Normalitas

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5. Linearity Test

The regression analysis requires that there must be a functional relationship between variables X and Y in a linear population, if between variables X and Y are not linear, the regression test cannot be continued or terminated. In this study, researchers used the SPSS program to test the linearity of the data, namely on the basis of decision making if the significance value is more than 0.05 (sig> 0.05), then the relationship between logical mathematical intelligence and problem solving abilities through a contextual approach is linear. Linearity results for this research variable, using IBM SPSS Statistics 25 are presented as follows.

Table 4. Linearity Test

ANOVA Table

			Sum of Squares	Df	Mean Square	F	Sig.
Kemampuan * Kecerdasan	Between Groups	(Combined)	126.015	10	12.602	1.663	.160
		Linearity	48.373	1	48.373	6.384	.020
		Deviation from Linearity	77.642	9	8.627	1.139	.383
	Within Groups		151.533	20	7.577		
	Total		277.548	30			

From the SPSS results above it shows that the significance value is greater than 0.05 (sig > 0.05) with a sig value of 0.383 > 0.05 then Ho is accepted which means that the variables of logical mathematical intelligence and mathematical problem solving ability have a linear relationship.

6. Test the Relationship between Mathematical Logical Intelligence and Mathematical Problem Solving Ability in Flat Sided Space Building Materials through a Contextual Approach

Untuk menguji hubungan antara kecerdasan logis matematis dengan kemampuan pemecahan masalah matematis pada materi bangun ruang sisi datar melalui pendekatan kontekstual, digunakan uji korelasi linear sederhana. Analisis korelasi bertujuan untuk mencari kekuatan hubungan antara variabel kecerdasan logis matematis dan variabel kemampuan pemecahan masalah matematis. Pada penelitian ini, untuk mencari analisis korelasi peneliti menggunakan korelasi product moment atau *pearson correlation.* untuk dasar pengambilan keputusan yang digunakan, berdasarkan taraf signifikansi 0,05 dengan kriteria hasil pengujian yaitu: apabila $t_{hitung} \geq t_{tabel,}$ maka tolak H_0, artinya signifikan dan apabila $t_{hitung} < t_{tabel,}$ maka terima H_0, artinya tidak signifikan. Untuk penafsiran kategori koefisien korelasi dengan pedoman sebagai berikut:

To examine the relationship between mathematical logical intelligence and mathematical problem solving abilities in the material of flat sided spaces through a contextual approach, a simple linear correlation test is used. Correlation analysis aims to find the strength of the relationship between variable X and variable Y. In this study, to seek correlation analysis, researchers used product moment correlation or Pearson correlation. The following is a simple linear correlation test hypothesis:

H0 : There is no relationship between mathematical logical intelligence and the ability to solve mathematical problems in the material of flat sided spaces through a contextual approach.

H1 : There is a relationship between mathematical logical intelligence and the ability to solve mathematical problems in the material of flat sided spaces through a contextual approach.

As for the basis for decision making used, based on a significance level of 0.05 with the criteria for the test results, namely: if tcount ≥ ttable, then reject H0, meaning it is significant and if tcount < ttable, then accept H0, meaning not significant. For the interpretation of the correlation coefficient category with the following guidelines:

Table 5. Category Product Moment Correlation Coefficient

Correlation Coefficient Interval	Category
0,00 – 0,20	Very low
0,21 – 0,40	Low
0,41 – 0,60	Currently
0,61 – 0,80	Well
0,81– 1,00	Very good

The results of simple linear correlation analysis for this research variable, using IBM SPSS Statistics 25 are presented as follows:

Table 6. Correlation Test

Correlations

		Kecerdasan Logis Matematis	Kemampuan Pemecahan Masalah
Kecerdasan Logis Matematis	Pearson Correlation	1	.417*
	Sig. (2-tailed)		.019
	N	31	31
Kemampuan Pemecahan Masalah	Pearson Correlation	.417*	1
	Sig. (2-tailed)	.019	
	N	31	31

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

The SPSS results above show that:

a. The significance value is less than 0.05 (0.019 <0.05), so the variables of mathematical logical intelligence and problem solving abilities through a contextual approach have a relationship or correlation.
b. The Pearson correlation value is 0.417, meaning that the Pearson correlation value is in the medium criteria, namely between 0.41 – 0.60 and has a positive value.

So it can be concluded that between logical mathematical intelligence and mathematical problem solving abilities through a contextual approach has a positive relationship with the criteria of a moderate correlation coefficient. So the higher a person's logical mathematical intelligence, the higher the ability to solve problems through a contextual approach.

After testing the correlation analysis, then the significance of the correlation was tested. To test the significance of simple linear correlation, the t-test statistical formula is used which is obtained as follows:

$$t = \frac{rxy\sqrt{n-2}}{\sqrt{1-rxy^2}} = \frac{0{,}417\sqrt{31-2}}{\sqrt{1-(0{,}417)^2}} = 2{,}471$$

Based on the test criteria with a significance level of 0.05 and a value of n = 31, then Ho is rejected because t count is 2.471 > t table 1.699. So it can be concluded that there is a positive and significant relationship between mathematical logical intelligence and the ability to solve mathematical problems in the material of flat sided spaces through a contextual approach.

7. Test the Effect of Mathematical Logical Intelligence on Mathematical Problem Solving Ability in Flat Sided Space Building Materials through a Contextual Approach

To test the effect of mathematical logical intelligence on mathematical problem solving abilities in the material of flat sided spaces through a contextual approach, a simple linear regression test is used. Regression analysis is used to make predictions (forecasting). The purpose of the regression analysis is to find a statistical model that is used to predict the value of the dependent variable based on the independent variables. The simple linear regression line equation used in predicting the values of the variables is used as follows $Y = a + bX$

In simple linear regression analysis, researchers used the IBM SPSS Statistics 25 program. The following is the simple linear regression line equation presented in the Coefficients table in SPSS.

Table 7 Coefficients in the Regression Test

Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	T	Sig.
(Constant)	3.360	4.097		.820	.419
Kecerdasan Logis Matematis	.265	.107	.417	2.474	.019

a. Dependent Variable: Kemampuan Pemecahan Masalah

From the coefficients table above, a constant value (a) of 3.360 is obtained and a mathematical logical intelligence value (correlation coefficient / b) of 0.265 so that the regression equation is obtained as follows $Y = 3{,}360 + 0{,}265X$

This means that the problem-solving ability variable has a consistent value of 3.360 and it can be said that for each addition of 1 unit of a person's mathematical logical intelligence value, the value of a person's problem-solving ability will increase by 0.265 through the application of a contextual approach.

After predicting the values of the variables, then the data is tested for significance. The following is the hypothesis regarding the simple linear regression analysis of this study:

H0 : There is no significant influence of mathematical logical intelligence on the ability to solve mathematical problems in the material of flat sided geometric shapes through a contextual approach.

H1 : There is a significant influence of mathematical logical intelligence on the ability to solve mathematical problems in the material of flat sided spaces through a contextual approach.

On the basis of decision making based on a significance level of 0.05 with the test results criteria, namely: if t count > t table, then reject H0, meaning it is significant and if t count < t table, then accept H0, meaning it is not significant. To see the significance (significance) of simple linear regression by looking at the t

count in the coefficient table above it is obtained at 2.474 and obtained t (α/2, n-k-1) of 2.045. Because t count is 2.474 > 2.045 t table, then reject Ho, which means that there is a significant influence of mathematical logical intelligence on the ability to solve mathematical problems in solid-sided geometric material through a contextual approach. Then for the coefficient of determination of simple linear regression between variables X and Y in this study, presented in the following table:

Table 8 Summary Model on Regression Test

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.417[a]	.174	.146	2.81116

a. Predictors: (Constant), Kecerdasan Logis Matematis

b. Dependent Variable: Kemampuan Pemecahan Masalah

In the Model Summary table, the coefficient of determination (R2) is 0.174, meaning that the value of the mathematical logical intelligence variable can explain the problem-solving ability variable value of 0.174 or 17.4% through the application of a contextual approach with the regression equation $Y = 3{,}360 + 0{,}265X$

Based on the results of the analysis of the two hypotheses above through simple linear correlation analysis and simple linear regression analysis, it can be concluded that mathematical logical intelligence has a positive and significant relationship with problem solving abilities on flat sided geometric material through a contextual approach. In addition, mathematical logical intelligence also has a significant influence on problem-solving abilities in flat sided geometric material through a contextual approach. By applying a contextual approach to learning, it means that if a person's logical-mathematical intelligence is higher, then the problem-solving ability of a person will also be higher. Therefore, after applying the contextual approach to the learning process, students' problem-

solving abilities are increasing in accordance with the students' logical-mathematical intelligence.

This is in line with the thesis research by Mawadda Warahma Akhmad with the title "The Influence of Logical-Mathematical Intelligence and Spatial-Visual Intelligence on Geometry Problem-Solving Ability of Class IV Students at MI Darul Ulum Kota Batu", which shows t arithmetic on logical-mathematical intelligence is greater than t table, namely 2.083> 1.667 and a significant value of 0.043> 0.05 means that mathematical logical intelligence has an influence on problem solving abilities but not significant. Other research that is in line with the results of this study, namely the thesis research by Eni Jubaidah with the title "The Influence of Hands On Activity Learning Models on Mathematical Problem Solving Ability in View of Student Learning Independence." students' problem-solving abilities in terms of learning independence.

This can also be seen based on the results of observations by researchers when carrying out the learning process with a contextual approach. Students who have the characteristics of high logical-mathematical intelligence (often representing their group to present the results of the discussion, often asking questions when they don't understand the material, actively answering when the teacher asks questions to students), when they are given questions about problem-solving abilities to discuss they have not can do it well, most of them have not been able to identify what is known and asked from the questions correctly. After the results of the discussion about problem solving abilities were discussed together by the teacher using a contextual approach they said they understood more than before. Then when given a test about their problem solving abilities they can work on the questions well and they are able to identify what is known and asked from the questions. From the discussion of the results of these observations it can be seen that it is not certain that students who have high mathematical logical intelligence also have high mathematical problem solving abilities. But after applying the contextual approach, students who have characteristics with high

logical-mathematical intelligence also have high mathematical problem-solving abilities, so they can solve problem-solving ability questions well.

C. Conclusion

Based on the results of research carried out by researchers at MTs Tauhidiyah Sulang Rembang with a sample of VIII B class students, totaling 31 students, it was obtained: 1) There is a positive and significant relationship between mathematical logical intelligence and mathematical problem solving ability on flat sided geometric material through contextual approach, meaning that if one's logical intelligence is higher then one's problem solving ability will also be higher by applying a contextual approach; 2) There is a significant influence of logical-mathematical intelligence on problem-solving abilities in flat-sided geometrical material through a contextual approach, namely problem-solving ability has a consistent value of 3.360 and it can be said that every addition of 1 unit of value of one's logical logical intelligence, the value of one's problem-solving ability will increase by 0.265 through the application of the context approachstual.

With the results of this study it is hoped that students will be able to get used to using their mathematical logical intelligence well in solving problem-based math problems. Because in solving math problems, good problem-solving skills are needed in order to be able to solve problems correctly and correctly. And can be a source of new knowledge for the wider community so that it can be utilized and practiced when encountering problems similar to this research.

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