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THE ROLE OF PRIOR MATHEMATICAL KNOWLEDGE AND INTEREST IN MATHEMATICS ON MATHEMATICAL CONCEPT UNDERSTANDING ABILITY IN SENIOR HIGH SCHOOL STUDENTS

Robiah Adawiyah[1], Meiliasari[2], Tian Abdul Aziz[3]

[1]Universitas Negeri Jakarta, Jalan Rawa Mangun Muka Raya No 11, Jakarta, Indonesia.
robiahadawiyah_1309818004@mhs.unj.ac.id
[2]Universitas Negeri Jakarta, Jalan Rawa Mangun Muka Raya No 11, Jakarta, Indonesia.
meiliasari@unj.ac.id
[3]Universitas Negeri Jakarta, Jalan Rawa Mangun Muka Raya No 11, Jakarta, Indonesia.
tian_aziz@unj.ac.id

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ABSTRACT

The role of prior mathematical knowledge and interest in mathematics as internal factors that can influence the mathematical concept understanding ability in learning mathematics in schools is important to consider. The purpose of this study was to determine the effect of prior mathematical knowledge and interest in mathematics to mathematical concept understanding ability. This study uses a quantitative research approach with data analysis techniques using multiple linear regression analysis. The participants in this study totaled 91 students who were all students of class X MA As-syafiiyah 02 Kota Bekasi for academic year 2022/2023. The results of this study were obtained: 1) Students' prior mathematical knowledge had a significant effect on students' mathematical concept understanding partially 2) Students' interest in learning mathematics had a significant effect on student's mathematical concept understanding partially 3) prior mathematical knowledge and interest in learning mathematics simultaneously had a significant influence to the mathematical concept understanding ability. This can be interpreted that the acquisition of students' mathematical concept understanding ability can be increased by considering the factors of prior mathematical knowledge and students' interest in learning mathematics.

Corresponding Author:

Robiah Adawiyah,
Department of Mathematics Education,
Universitas Negeri Jakarta,
Jl. Rawa Mangun Muka Raya No. 11, Jakarta , Indonesia
Email: robiahadawiyah_1309818004@mhs.unj.ac.id

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INTRODUCTION

Mathematics is a science that has been known to mankind since thousands of years ago. Along with the development of the times, mathematics has also developed into various technological applications. Mathematics has played a major role in the progress of civilization until now, such as geometry, calculus, probability and many others which have become the foundation of new disciplines that continue to develop. According to Dündar and Çakiroğlu (2013) mathematics is not only about numbers, calculations and theorems, but more than that mathematics plays an important role as part of the solution to the problems of human life. Therefore, studying mathematics is important for mankind for an increasingly advanced and modern life.

The magnitude of the role of mathematics makes various countries in the world require mathematics as one of the subjects that must be learned by students at the school level. In Indonesia, mathematics lessons are required to be learned by students from elementary to secondary levels. Referring to Permendiknas 2006 and NCTM (2000) one of the main mathematical abilities that must be learned and developed in students is the ability to understand mathematical concepts. This ability is essential and very important to be developed in students because at first students learn mathematics by understanding a concept. Because mathematics is a structured and deductive science, so by understanding a concept it will be easier for students to understand the next related concept. Therefore, students' mathematical concept understanding ability is the main thing in learning mathematics as according to Santrock (2018) argues that the key aspect of learning mathematics is understanding concepts. Through a good conceptual understanding, it will support other mathematical abilities, namely reasoning abilities, problem solving abilities, mathematical representations and other mathematical abilities.

Sudijono (2008) stated that understanding is a person's ability to understand something after the person previously knew about it. Therefore, the ability to understand is a higher level ability than just knowing something. In addition, Kilpatrick (2001) defines that understanding mathematical concepts is an integrated understanding of mathematical ideas. So it can be said that understanding mathematical concepts is the ability of students to interpret mathematical ideas and ideas as a whole.

Sanjaya (2009) states that indicators of understanding concepts include: a) being able to verbally explain the concepts he is learning; b) Being able to present mathematical situations in various ways; c) Being able to classify objects based on the requirements that make up the concept; d) Being able to apply the relationship between concepts and procedures; e) Being able to give examples and non-examples; f) Being able to apply the concept in an algorithm; g) Being able to develop the concepts that have been learned. As for Kilpatrick et al. (2001) stated that a significant indicator in understanding mathematical concepts is the ability to represent mathematical situations in different ways. This aims to see how students are able to find various representations related to other forms, because according to him the level of students' mathematical understanding ability is determined by how many or few connections students can create. In addition, he also stated that if students have gained an understanding of mathematical concepts then they will be able to know the relationships and the proper use between concepts, facts and procedures.

In order for students to understand a mathematical concept better, it is necessary to have prior mathematical knowledge. Prior mathematical knowledge is a provision of knowledge for students in learning mathematical concept. This is because mathematics is a structured science, a concept will always be related to the previous concept. So that prior mathematical knowledge becomes prerequisite knowledge that is important for constructing knowledge

with learning outcomes. Hanun (2010) defines prior mathematical knowledge as cognitive abilities that students have previously possessed where this knowledge is a prerequisite for students to learn new material in mathematics lessons. As according to Caillies et al. (2002) it is often for students when studying mathematics to rely on their memory of prior knowledge of mathematical concepts that have been studied previously. Therefore, the role of initial abilities is very important because it helps students to more easily understand a new concept in mathematics lessons because prior mathematical knowledge serve as a basis for students to link concepts that have been understood to a new concept that is being studied which in the end is constructed a new understanding of mathematical concept.

The effectiveness of learning mathematics is not only supported by cognitive factors but must also pay attention to psychological factors. One aspect psychological student that is important in the process of learning mathematics is interest in mathematics. According to research conducted by Winata and Friantini (2020) , which examines interest in learning mathematics, it states that groups of students with high learning interest provide better results in understanding a mathematical concept. This can be because by having a high interest in learning, students will give higher attention and effort in understanding a lesson. According to Djamarah (2015) interest is tendency to continue pay attention to something. So that students who have an interest in mathematics will give attention and effort to study maximally in the lesson of mathematics which he is interested in. This of course has a positive effect on student mathematics learning outcomes. So that the role of interest in learning mathematics becomes important in the process of learning mathematics, especially in developing the ability to understand mathematical concepts apart from prior mathematical knowledge.

Winninger et al. (2014) mentioned a number of indicators of interest in learning mathematics including: a) Feelings, how students feel about mathematics, whether students are happy with mathematics or they find mathematics is boring; b) Understanding Lessons, students' attitudes in interpreting mathematics; c) Knowledge, student's perception of knowledge of mathematics, whether he feels good at mathematics or feels stupid at mathematics; d) Involvement in school, student involvement in mathematics lessons at school; e) Involvement outside of school, the involvement of students in mathematics lessons outside of school.

Based on the discussion that has been described above, it can be said that the prior mathematical knowledge and interest in mathematics are important to consider as influencing factors on the mathematical concept understanding ability. So this study aims to determine the effect of prior mathematical knowledge and interest in mathematics to the mathematical concept understanding ability.

METHOD

In this research used is a type of quantitative research with survey methods . The research location was conducted at MA As-Syafiiyah 02 Kota Bekasi in October 2022. The number of participants was 91 students which is the total number of class X students at the school. This refers to the opinion of Arikunto (2006) which states that if there are less than 100 participants then the samples taken are all. Research data collection was carried out by giving questionnaires and tests. The test technique is carried out by providing a test instrument consisting of a series of questions to obtain data regarding students' abilities in the cognitive aspect (Lestari and Yudhanegara, 2015) . The test was given twice. the first test is a test to measure prior mathematical knowledge while the second test is conducted to measure the mathematical concept understanding ability. the topic of mathematics on prior mathematical knowledge test is the topic of system of linear equations of two variables while the test to measure the mathematical concept understanding ability is the topic of system of linear

equations of three variables. While collecting data by giving a questionnaire is done by submitting a list of questions that ask for opinions or attitudes of students about students' interest in learning mathematics. The instrument validity test was carried out using two approaches, namely an approach called content validity and an empirical validity approach. The content validity can be determined based on expert judgment. The method used to measure content validity in this study is the Content Validity Ratio (CVR) by Lawshe (1975). While the empirical validity is done by looking at the person product moment value and the reliability of the instrument is done by looking at the value of Cronbach's Alpha. Data analysis in this study was carried out using multiple linear regression analysis. The entire series of tests in the data analysis requirements were carried out with the SPSS version 29 application.

RESULTS AND DISCUSSIONS

Results

To find out the effect of prior mathematical knowledge and interest in mathematics to mathematical concept understanding ability, multiple linear regression analysis was carried out. The prior mathematical knowledge as X1 and interest in mathematics as X2 are the independent variables, while the mathematical concept understanding ability as Y is the dependent variable. Before carrying out a regression analysis, there are several assumptions that must be met, namely normality, heteroscedasticity, multicollinearity and autocorrelation (Suyono, 2015).

Normality test was performed for knowing whether residual or errors random normally distributed or no. Normality test carried out with One Sample Kolmogorov Smirnov test method. Criteria the test is if mark significance (Asym Sig 2 tailed) > 0.05, the residuals are normally distributed. If mark significance (Asym Sig 2 tailed) < 0.05 then the residual is not normally distributed.

Table 1 Tests of Normality

	Kolmogorov-Smirnov [a]		
	Statistics	df	Sig.
Unstandardized Residuals	080	91	.200 [*]

Based on table seen the significance value is 0.200 > 0.05, then it can be said that the assumption of residual normality is fulfilled.

Heteroscedasticity test aim to determine if there is an unequal variance of the reiduals in the regression model. Heteroscedasticity test examined with the Glejser test with criteria testing that is if mark significance > 0.05 was concluded assumption homoscedasticity fulfilled or in other words no occur symptom heteroscedasticity.

Table 2 Glesjer Test

		Unstandardized Coefficients		Standardized Coefficients		
Model		B	std. Error	Betas	t	Sig.
1	(Constant)	-5,851	5,400		-1,083	.282
	X1 (KAM)	048	.049	.110	.982	.329
	X2 (Interest)	.232	.130	.199	1,786	.078

referring table from testing glesjer showing mark significance X1 or variable from prior mathematical knowledge is 0.329 and value significance X2 or variable from interest in mathematics is is 0.078. Second mark the more big from 0.05, up to in conclusion no occur symptom heteroscedasticity in research data.

Multicollinearity test was performed for knowing is there any correlation between variable independent in the regression model that has been set. In order to know the existence of multicollinearity, we can see the VIP (Variance Inflation Factor) and Tolerance values in the following table.

Table 3 Multicollinearity Test

	Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
Model	B	Std. Error	Beta	t	Sig.	Tolerance	VIF
(Constant)	-7.065	8.357		-.845	.400		
X1	.683	.076	.679	8.971	<,001	.849	1.177
X2	.432	.201	.162	2.148	.034	.849	1.177

As for criteria commonly used is if tolerance value > 0.10 and VIP value < 10 then matter the showing no occur multicollinearity. From the table is known that tolerance value for variable X1 and X2 study mathematics is 0.849 > 0.10 as well VIP value for second variable X1 and X2 is 1.177 < 10. That lead to a conclusion that no occur multicollinearity between variable independent.

Autocorrelation showing exists correlation among the residuals in the established regression model. It is important to fulfill the assumption that the residuals are not correlated to each other in order to facilitate further analysis in the regression process. The test method for determining the occurrence of autocorrelation can be carried out using the Durbin-Watson test with the results shown in the following table.

Table 4 Durbin-Watson Test

Model	R	R Square	Adjusted R Square	std. Error of the Estimate	Durbin-Watson
1	.757[a]	.572	.563	9,505	1,758

As for test criteria

$H_0: \rho = 0$(no correlation)

$H_1: \rho > 0$(positive correlation)

referring from table, value Durbin-Watson statistics are dw = 1.758. Furthermore, this value is compared with the Durbin Watson table (du) because the value is 1.758 (dw) > 1.7026 (du), it is concluded that there are no autocorrelation symptoms.

The test results for the all analysis prerequisites have been fulfilled. Then the data can be analyzed with multiple linear regression.

The F test was carried out with the aim of measuring the influence of the independent variables on prior mathematical knowledge and interest in mathematics simultaneously on the dependent variable, mathematical concept understanding ability. The formulation of the hypothesis is:

$H_0: \beta_1 = \beta_2 = 0$
H_1:There is a sign $\neq$

Table 5 F Test

Model	Sum of Squares	df	MeanSquare	F	Sig.
Regression	10643549	2	5321.774	58,901	< .001b
residual	7950891	88	90,351		
Total	18594.440	90			

The provisions are if F count > F table then H_0 rejected. Referring to table 5, the calculated F value obtained is 58,901 while the F table value is 3.10, so F count > F table, so that the conclusion is obtained that the prior mathematical knowledge and interest in mathematics simultaneously have a significant effect on the mathematical concept understanding ability.
After the F test states there is a significant effect of the prior mathematical knowledge and interest in mathematics simultaneously on the mathematical concept understanding ability, then a t test was carried out. The t test was carried out to determine the effect of each independent variable on the dependent variable. The following presents the results of the t test listed in table 6.

Table 6 t Test

		Unstandardized Coefficients		Standardized Coefficients		
Model		B	std.Error	Betas	t	Sig.
1	(Constant)	-7,065	8,357		-.845	.400
	X1	.683	076	.679	8,971	<.001
	X2	.432	.201	.162	2.148	.034

1) The Effect of prior mathematical knowledge to Mathematical Concept Understanding Ability as for the test hypothesis 1 is
$H_0: \beta_1 = 0$
$H_0: \beta_1 \neq 0$
The provisions are if t arithmetic > t table then H_0 rejected. Referring to the table, variable X1, prior mathematical knowledge, obtains a t count value of 8,971 while the t table is 1.987, so t count > t table, so H_0 rejected. So the conclusion is that there is a

significant influence from the prior mathematical knowledge to mathematical concept understanding ability if the interest in mathematics is also taken into the model.

2) The Effect of Interest in Mathematics on to Mathematical Concept Understanding, while the test hypothesis 2 is

   $H_0: \beta_2 = 0$

   $H_0: \beta_2 \neq 0$

   The provisions are if t arithmetic > t table then H_0 rejected. Referring to the table, variable X2, interest in mathematics, obtains a t-count value of 2,148 while the t-table value is 1.987, so t count> t table, so H_0 rejected. So the conclusion is that there is a significant effect of interest in mathematics to mathematical concept understanding if prior mathematical knowledge are also taken into the model.

The coefficient of determination describes the ability of a regression model made in explaining the variation of the dependent variable. The coefficient of determination is presented in table 7 as follows.

Table 7 Coefficient of Determination

Model	R	R Square	Adjusted R Square	std. Error of the Estimate
1	.757 [a]	.572	.563	9,505

Referring to the table, it is stated that the *R Square value is* 0.572. This can be interpreted that the variables of prior mathematical knowledge and interest in mathematics have a joint contribution of 57.2% to the ability to understand mathematical concepts while the remaining 42.8% is influenced by other variables. which are not included in the linear regression model in this study. The amount of this contribution reaches more than 50% which indicates that the factors of prior mathematical knowledge and interest in mathematics are aspects that play an important role in gaining students' mathematical concept understanding ability.

Discussions

Based on the results of data analysis, in hypothesis 1, H_0 it states that there is no significant effect of prior mathematical knowledge variable to mathematical concept understanding ability. However, in the t-test results the prior mathematical knowledge variable obtained a t-count value of 8,971, while a t-table value of 1.987 so that t-count > t-table and a significance value of 0.001 <0.05 so that hypothesis 1 H_0 was rejected which concluded that there was a significant effect of prior mathematical knowledge variable to mathematical concept understanding ability.

This is also in line with the opinion of Bringula (2016) which states that having prior mathematical knowledge helps students to gain a better understanding of concepts in learning mathematics. This indicates that prior mathematical knowledge have a positive effect on students' ability to understand mathematical concepts, which results are in line with the results of the t test in this study that there is a significant effect of prior mathematical knowledge to mathematical concept understanding ability.

In hypothesis 2, H_0 it states that there is no significant effect of the variable interest in mathematics to mathematical concept understanding ability. However, in the t-test results the initial ability variable obtained a t-count value of 2,148, while a t-table value of 1.987 so that

t-count > t-table and a significance value of 0.034 <0.05 so that hypothesis 2 H_0 was rejected which concluded that there was a significant influence of interest in mathematics to mathematical concept understanding ability.

This is in accordance with research conducted by Winata and Friantini (2020) which examines interest in mathematics which states that groups of students with high learning interest provide better results in understanding a mathematical concept. This indicates that interest in mathematics has a positive effect on the ability to understand students' mathematical concepts, which results are in line with the results of the t test in this study that there is a significant influence of interest in mathematics to mathematical concept understanding ability.

Referring to all the test results that have been described, the f test and t test. in general it can be said that the prior mathematical knowledge and interest in learning mathematics have a significant effect to mathematical concept understanding ability. An expert, Krapp (1999) states that with an interest in learning, students will try and prepare themselves more highly to complete tasks related to the things they are interested in. This of course encourages students to be more enthusiastic in understanding mathematics subject matter which in turn makes students gain a good understanding of mathematical concepts.

Likewise with aspects of prior mathematical knowledge, according to Kendeau & Broek (2007) students in learning a subject matter are influenced by prior knowledge. In addition, research from the results of Linnenbrink-Garcia et al. (2012) shows that early mathematical abilities have a positive effect to mathematical concept understanding. So that to gain good understanding of mathematical concepts, one way that can be done is to increase students' interest in mathematics and to optimize students' prior mathematical knowledge.

CONCLUSION

Based on the description of the research results with reference to empirical data, it can be concluded that 1) Students' prior mathematical knowledge has a significant effect to mathematical concept understanding ability partially 2) Students' interest in mathematics has a significant effect on students' mathematical concept understanding ability partially 3) prior mathematical knowledge and interest in mathematics simultaneously have a significant effect to mathematical concept understanding ability. This can be interpreted that the acquisition of students' ability to understand mathematical concepts can be increased by considering the factors of prior mathematical knowledge and students' interest in mathematics.

REFERENCES

Anas Sudijono. (2008). *Pengantar Evaluasi Pendidikan*. Raja Grafindo Persada.

Arikunto, S. (2010). *Prosedur Penelitian Suatu Pendekatan Praktik*. Rineka Cipta.

Bringula, R. P., Basa, R. S., Dela Cruz, C., & Rodrigo, M. M. T. (2016). Effects of Prior Knowledge in Mathematics on Learner-Interface Interactions in a Learning-by-Teaching Intelligent Tutoring System. *Journal of Educational Computing Research*, *54*(4), 462–482. https://doi.org/10.1177/0735633115622213

Caillies, S., Denhière, G., & Kintsch, W. (2002). The effect of prior knowledge on understanding from text: Evidence from primed recognition. *European Journal of Cognitive Psychology*, *14*(2), 267–286. https://doi.org/10.1080/09541440143000069

Djamarah, S. B. (2015). *Psikologi Belajar*. PT Rineka Cipta.

Dündar, S., & Çakiroğlu, M. (2013). Why Should the Mathematics History Be Used in Mathematics Education? / Matematik Tarihi Matematik Eğitiminde Neden Kullanılmalı?

Eğitimde Kuram ve Uygulama, *10*(2), 522-534–534. https://dergipark.org.tr/en/pub/eku/74069

Guo, J. P., & Pang, M. F. (2011). Learning a mathematical concept from comparing examples: The importance of variation and prior knowledge. *European Journal of Psychology of Education*, *26*(4), 495–525. https://doi.org/10.1007/s10212-011-0060-y

Hanun, F. (2010). Pengaruh Metode Pembelajaran dan Kemampuan Awal Terhadap Hasil Belajar Matematika (Studi Eksperimen di MAN 3 Jakarta). *Widyariset*, *13*(1), 123–133. https://widyariset.pusbindiklat.lipi.go.id/index.php/widyariset/article/view/139

Kendeau, P., & Broek, P. van der. (2007). Kendeou_2007. *Memory & Cognition*, *35*(7), 1567–1577.

Kilpatrick, J., Swafford, J., & Findell, B. (2001). Adding It Up: Helping Children Learn Mathematics. In *October* (Issue October). National Academy Press.

Krapp, A. (1999). Interest, motivation and learning: An educational-psychological perspective. *European Journal of Psychology of Education*, *14*(1), 23–40. https://doi.org/10.1007/BF03173109

Lestari, K. E., & Yudhanegara, M. R. (2015). *Penelitian Pendidikan Matematika*. PT Refika Aditama.

NCTM. (2000). *Principles and Standards for School Mathematics*. The National Council of Teachers of Mathematics.

Sanjaya. (2009). *Strategi Pembelajaran Berorientasi Standar Proses Pendidikan*. Prenada Media Grup.

Santrock, J. W. (2018). Educational psychology, 6th ed. In *Educational psychology, 6th ed.*

Suyono. (2015). *Analisis Regresi untuk Penelitian*. deepublish CV Budi Utama.

Winata, R., & Friantini, R. N. (2020). Kemampuan Pemahaman Konsep Matematika Siswa Ditinjau Dari Minat Belajar Dan Gender. *AlphaMath : Journal of Mathematics Education*, *6*(1), 1. https://doi.org/10.30595/alphamath.v6i1.7385

Wininger, S. R., Adkins, O., Inman, T. F., & Roberts, J. (2014). Development of a Student Interest in Mathematics Scale for Gifted and Talented Programming Identification. *Journal of Advanced Academics*, *25*(4), 403–421. https://doi.org/10.1177/1932202X14549354