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The Relationship Of Students' Initial Abilities With The Ability To Solve Mathematics Story Problems

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Abstrak

Tujuan dari penelitian ini adalah untuk menyelidiki potensi korelasi antara kemampuan awal siswa dan kemahiran mereka dalam memecahkan soal cerita matematika pada siswa kelas dua belas di SMA Negeri 1 Touluaan. Metodologi yang digunakan memerlukan penggunaan teknik berbasis survei, khususnya yang menggunakan ukuran kuantitatif. Variabel bebas dalam penelitian ini berkaitan dengan bakat awal siswa, sedangkan variabel terikatnya terfokus pada kemampuan menjawab soal cerita. Alat penilaian yang digunakan dalam penelitian ini terdiri dari ujian tertulis yang diberikan kepada peserta. Tes ini dirancang untuk mengevaluasi kemampuan awal mereka dan menilai keterampilan pemecahan masalah mereka melalui penyelesaian soal cerita. Temuan yang diperoleh dari penelitian ini menunjukkan korelasi yang signifikan dan menguntungkan secara statistik antara kapasitas kognitif awal siswa dan kemahiran mereka dalam menyelesaikan tugas-tugas matematika berbasis narasi. Koefisien korelasi yang diamati sebesar 0,734, menunjukkan hubungan positif sedang antara keterampilan awal siswa dan kemahiran mereka dalam memecahkan masalah narasi. Selanjutnya kontribusi kemampuan awal siswa terhadap kinerjanya dalam memecahkan soal cerita matematika ditemukan sebesar 53,8%.

Kata Kunci: *Kemampuan awal siswa, soal cerita matematika, matematika.*

Abstract

The objective of this study is to investigate the potential correlation between students' initial abilities and their proficiency in solving mathematical narrative problems among twelfth-grade students at SMA Negeri 1 Touluaan. The employed methodology entails the utilization of a survey-based technique, specifically employing quantitative measures. The independent variable in this study pertained to the initial talents of the students, whereas the dependent variable focused on their capacity to answer story issues. The assessment tools employed in this study consisted of written exams administered to participants. These tests were designed to evaluate their initial abilities and assess their problem-solving skills through the completion of story problems. The findings derived from this study indicate a statistically significant and favorable correlation between students' initial cognitive capacities and their proficiency in solving narrative-based mathematical tasks. A correlation coefficient of 0.734 was observed, indicating a moderate positive relationship between students' starting skills and their proficiency in solving narrative issues. Furthermore, the contribution of students' initial abilities to their performance in solving story problems was found to be 53.8%.

Keywords: *students' initial abilities*, *math story problems*, *mathematics*.

INTRODUCTION

Learning is a dynamic and transformative process where acquiring knowledge and skills is facilitated through the assimilation and interpretation of personal experiences. The emergence of information technology has expanded the concept of learning beyond separate activities independent of human existence (Andriani, 2016; Fahyuni, 2017; Amarini, 2018). Learning is a cognitive process carried out by humans to acquire new knowledge or skills, resulting in fundamental behavioral modifications. This transformation is realized through the individual's active involvement and interaction with the surrounding environment (Simbolon, 2014; Oktiani, 2017; Yuhana & Aminy, 2019).

Acquiring mathematical knowledge involves understanding the concepts and structures of the subject matter while actively seeking relationships and correlations between these mathematical elements. The main aim of education is to facilitate students' understanding of the information presented (Ichsan, 2016; Santoso, 2017; Yulianty, 2019). Achieving educational goals results from practical efforts that enable students to understand the material offered thoroughly (Warmi, 2016; Sarwoedi et al., 2018; Yulianty, 2019).

Education can be achieved through the learning process, which includes acquiring knowledge, skills, habits, and attitudes by individuals. The concept of learning relates to individuals through a transformative process in their attitudes and behavior (Ningsih, 2014; Cleopatra, 2015; Ginanjar, 2019). Usually, this transition occurs gradually and lasts for quite an extended period. The visibility of this transformation will likely be increased through the active

involvement and collaboration of relevant stakeholders (Nurbaeti, 2016; Astuti, 2022). Even though there is a behavior modification process, the absence of exertion prevents its classification as a form of learning (Rahmayanti, 2016; Erwinsyah, 2017; Yuhana & Aminy, 2019). The interpretation of this statement shows that achieving educational goals depends on how students are involved in the learning process (Inah, 2015; Bistari, 2017; Sodik et al., 2019).

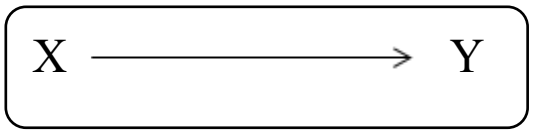
Students' learning processes are inevitably influenced by their abilities. Each student has a unique ability. Individual learning outcomes may differ based on their skills, even when faced with the same learning method (Sururiyah, 2018; Puspitarasari & Walujo, 2020; Dewi et al., 2023). Students with good initial abilities can handle the subsequent learning process. In the next phase, initial talent undergoes further development in line with the goals to be achieved (Lusiani et al., 2018; Laman, 2019; Aulia, 2020). However, if students have low initial abilities, they tend to face challenges in achieving the required goals, resulting in a long duration to achieve the desired goals (Herawati, 2013; Kurniawati et al., 2015; Suebiyanto & Masykuri, 2016).

According to Ausubel's thesis, it is imperative to ensure students' prior knowledge to acquire new information. Previous research shows that students' existing knowledge and prior abilities are essential in facilitating their understanding and integration of the subject matter studied (Jatisunda, 2016; Shidik, 2019).

Hi, based on the results of observations and observations during the implementation of PPL at SMA Negeri 1 Touluaan, it was found that students' ability to solve story problems was relatively low. Even though teachers have made many efforts, problems still need to be solved in teaching mathematics. As said by some mathematics teachers, the problem often encountered is the problem of students having difficulty solving word problems. This is following my observations during teaching. Students tend to feel stupid/do not want to know about their abilities and need help understanding the symbols used. In mathematics, it is challenging to change story problem sentences into mathematical form, and based on the results of the story problem test that I gave to students, it was proven that the score achieved was less than the predetermined KKM value. This may occur due to students needing more initial ability to learn mathematics. Even though mastery of mathematics is every student's dream, in reality, students' success in learning mathematics varies depending on their abilities.

METHOD

The research method used is a survey research method with a quantitative approach. This research consists of one independent variable and one dependent variable. This design is described as follows:



Information:

X = Student's Initial Ability

Y = Ability to Solve Story Problems

This research was conducted on class XII students of SMAN 1. TOULUAAN. In the even semester of the 2022/2023 academic year. The instrument in this study was administering a written test that the respondent had to take to measure the student's initial abilities and ability to solve math word problems. The initial ability test is a tool to measure the extent of a student's initial understanding of learning mathematics before teaching is given and the ability before the respondent works on word problems. The data collection technique in this research was obtained through tests. The first test used was an objective test to obtain variable data on students' initial abilities and a description test to obtain variable data on the ability to solve math word problems.

RESULT AND DISCUSSION

1. Data Description

This research was conducted at SMA Negeri 1 Touluaan. The population in this study were all class XII students at SMA Negeri 1 Touluaan for the 2022/2023 academic year, namely 75 students and a sample of 31 students. Data from the research results were taken in two forms of tests, namely objective questions for the Student Initial Ability Test (X) and description questions for the Ability to Solve Mathematics Story Problems Test (Y). Before conducting data collection, the researcher conducted a content validity test on the instrument to be used. This validity test was designed and created by researchers with the help of academic advisors and math teachers at school.

After obtaining the data, the researcher used computer assistance using the SPSS and MS Excel programs to test the hypothesis. However, before testing the hypothesis, a data normality test was carried out using Kolgomorov-Smirnov to find out whether the data was distributed normally or not, and a linearity test was carried out using the Test for Linearity with the help of the SPSS program.

2. Student's Initial Abilities

Obtained for the average yield (mean) = 85.8387; mean value (median) = 94; frequently occurring value (mode) = 94; standard deviation (standard deviation) = 16.6735; variance = 278,006; minimum value = 49; maximum value = 100 and the total value is 2661.

Table 1. Descriptive Statistics of Students' Initial Ability

	N	Minimum	Maximum	Mean	Std. Deviation	variance	Sum
Student's Initial Ability	31	49.00	100.00	85.8387	16.67353	278.006	2661
Valid N (listwise)	31						

3. Ability to Solve Math Story Problems

Obtained for average results (mean) = 84.7419; middle value (median) = 85; frequently occurring value (mode) = 95; standard deviation (standard deviation) = 8.57892; variance = 73.5978; minimum value = 65; Maximum score = 95 and total score is 2627.

Table 3. Descriptive Statistics of Ability to Solve Story Problems

	N	Minimum	Maximum	Mean	Std. Deviation	variance	sum
Ability ti Solve Math Story Problem	31	65.00	95.00	84.7419	8.57892	73.5978	2627
Valid N (listwise)	31						

4. Prerequisite Testing

1). Data Normality Test

The data normality test is said to be normally distributed if the significance value is more than α = 5% (0.05). The results of the normality test for students' initial abilities and ability to solve math word problems are seen in Table 4.

Table 4. Results of the One-Sample Kolmogorov-Smirnov Test Data Normality

		Student's Initial Abilities	Ability to Solve Math Story Problems
N		31	31
Normal Parameters[a,b]	Mean	85.8387	84.7419
	Std. Deviation	16.67353	8.57892
Most Extreme Differences	Absolute	.148	.157
	Positive	.148	.116
	Negative	-.146	-.157
Test Statistic		.148	.157
Asymp. Sig. (2-tailed)		.082[c]	.049[c]

Based on Table. 4, it is clear that the significance value of the student's initial ability variable is 0.082, and the significance value of the ability variable to solve story problems is 0.049. So, the student's initial ability variable and the ability variable to solve story problems have a normal distribution.

2). Data Linearity Test

The results of the linearity test are said to have a linear pattern if the significant value (Linearity) is less than α = 5% (0.05). The results of the Linearity Test of Students' Initial Ability with the Ability to Solve Story Problems can be seen in Table 5.

Table 5. Results of Test for Linearity ANOVA Table

			Sum of Squares	df	Mean Square	F	Sig.
Ability to Solve Story Problems * Students' Initial Ability	Between Groups	(Combined)	1504.305	8	188.038	5.879	.000
		Linearity	1189.501	1	1189.501	37.191	.000
		Deviation from Linearity	314.803	7	44.972	1.406	.252
	Within Groups		703.631	22	31.983		
	Total		2207.935	30			

Based on Table. 5 shows that the significant value on the linearity variable of students' initial abilities with the ability to solve math story problems is 0.000. This means that the significant value is 0.000 <0.05 so that students' initial abilities and the ability to solve story problems have a linear relationship.

5. Hypothesis Testing

Hypothesis testing was carried out using the Pearson Product Moment correlation technique with the help of the SPSS program. Next, the significance of the correlation between variables X and Y is determined by comparing tcount with t_{table}.

Research hypothesis: A positive and significant relationship exists between students' initial abilities and their ability to solve math story problems. The following calculation results: Finding the X and Y correlation values, with the Pearson Product Moment correlation formula using SPSS for Windows, can be seen in Table 6.

Table 6. Correlation Coefficient Between Variables X and Y

		Student's Initial Ability	Ability to Solve Story Problem
Student's Initial Ability	Pearson Correlation	1	.734**
	Sig. (2-tailed)		.000
	N	31	31
Ability to Solve Story Problem	Pearson Correlation	.734**	1
	Sig. (2-tailed)	.000	
	N	31	31

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

Based on Table. 6, it can be seen that the correlation coefficient between variables X and Y is 0.734. Following the interpretation value of the correlation coefficient, the two variables are stated to have a strong interpretation. Find the size of the contribution from variables X and Y using the coefficient of determination formula:

$$KP = r^2 \times 100\%$$
$$KP = 0{,}734^2 \times 100\%$$
$$r^2 = 0{,}538 \text{ in percent } 53.8\%$$

Therefore, the coefficient of determination r^2 = 0.538, or the student's initial ability variable, contributes to the ability to solve word problems by 53.8%, and the remaining 42.6% is influenced by variables outside the student's initial ability. Testing the significance of the correlation coefficient with the t-test statistic:

$$t = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}}$$
$$t = \frac{0{,}734\sqrt{31-2}}{\sqrt{1-0{,}538}}$$
$$t = \frac{0{,}734\sqrt{29}}{\sqrt{1-0{,}538}}$$
$$t_{count} = 8{,}549$$

Next is the significance test, namely comparing with t_{table}. Condition: if $t_{count} > t_{table}$ then accept H_0. At the error level α = 5% or significant 0.05, n = 31-2 = 29, then t_{table} = 2.452, thus this test obtained $t_{count} > t_{table}$. From the results of calculating the Pearson product-moment analysis using SPSS, the correlation coefficient for r_{xy} is 0.734. Therefore, the correlation coefficient of determination determinasi $(r^2) = 0{,}538$ or 53.8%. This means that students' initial abilities contribute to students' ability to solve math story problems by 53.8%. Furthermore, the significance of each correlation coefficient using the t-test statistic, at an error level of α = 5% or significant 0.05, n = 31-2 = 29, t_{count} = 8.549 and t_{table} = 2.452. Moreover, it turns out that $t_{count} > t_{table}$ is obtained to conclude that there is a positive and significant relationship between students' initial abilities and the ability to solve math word problems.

6. Discussion

This study aimed to determine the potential correlation between students' initial abilities and their proficiency in solving math word problems in class XII students at SMA Negeri 1 Touluaan. The variables of initial ability (X) and ability to answer math narrative questions (Y) for each student are distributed according to the normal distribution determined by the prerequisite test. In the context of student performance, there is a linear relationship between the characteristics of the initial ability and the ability to solve math story problems.

Pearson Product Moment analysis performed using SPSS yielded a statistically significant correlation coefficient of 0.734 at 0.05. Based on the coefficient of determination of 0.538, around 53.8% of the variability in the ability to solve word problems can be caused by the effects of students' basic abilities and the continuity factor. These components, which account for 46.2% of the variance, are further influenced by variables that have yet to be identified or investigated by the researcher. The findings of this study demonstrated a statistically significant and favorable

correlation between students' initial cognitive capacities and their proficiency in solving math story problems.

The impact of students' initial ability to solve math story problems was a significant component, accounting for 46.2% of the variance in students' problem-solving skills. According to Cooney (2000), several factors contribute to students' challenges in solving math problems through stories. These factors include a lack of conceptual knowledge, such as understanding the meaning of certain words or terms. In addition, students may have difficulty articulating problems in their own words and applying mathematical principles, which involve identifying what information is known and what is asked. In addition, the lack of understanding of the principles used to interpret story problems and the inability to apply these principles can also hinder students' ability to solve these problems. Cooney's perspective is in line with the findings of this study because it reveals that many variables influence students' talent in solving math story problems.

This research, conducted at SMA Negeri 1 Toluaan, identified a significant factor influencing students' proficiency in solving word problems: a marked deficiency in students' initial understanding of mathematical ideas, which accounted for 53.8% of the observed variance. Students' initial proficiency serves as a prerequisite for effectively answering math word problems.

CONCLUSION

Based on the results of the research and discussion above, it can be concluded that there is a positive and significant relationship between students' initial abilities and the ability to solve math story problems for class XII students of SMA Negeri 1 Touluaan in the 2016/2017 academic year with a correlation coefficient of 0.734 and the contribution of students' initial abilities to students' ability to solve math story problems was 53.8%.

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