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The Relation Between Learning Mathematics and Students' Competencies in Understanding Texts

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Abstract: This study was a descriptive study that aimed to gain an overview on the relation between learning mathematics and students' competencies in understanding texts. This research was classified as an ex post facto study due in part to the variable studied is the variable that was already happening. While the technique of taking the sample using stratified proportional sampling techniques. These techniques have been selected for the condition of the population, in the context of learning mathematics, diverse and also tiered. The results of this study indicate that there is a relationship between learning mathematics and students' competencies in understanding texts.

INTRODUCTION

The text can be either the original words of the authors; or written material as the basis for giving lessons, speeches, and so on. Text can also be in the form of written discourse [1]. Therefore, the text is composed follow the rules of the standard language. Mahsun [2] states that the text as a linguistic unit has a complete thinking structure. This means that each text is arranged in the pattern and thinking structure of it. While the mathematics, though mathematicians differ on mathematical sense, at least as stated in Wikipedia [3] mathematics can be seen as the study of topics such as quantity (number), structure, space, and change. Therefore, Jarrett [4] states that learning mathematics involves observation of patterns, testing of conjectures, and estimation of results.

Though mathematics and text are two different things, the relationship between mathematics and language, in the context of expression, has long been recognized. That way, it is commonly heard the statement saying mathematics is the symbolic expression of language, while the language is a verbal expression of mathematics. Regarding the phrase, Moursund [5] stated that although mathematics and reading are two separate matters, it is clear that the two are closely related. Numbers and other mathematical expression is part of the words in a text or speaking. Greabell cite in Fite [6] states that reading and mathematics share the common elements. They are abstract, involving symbols, require cognitive processes, and also require knowledge of the interaction of various discrete skills.

Khisty and MacGregor cite in Wiest [7] also assert that although language and mathematics differ in expressing their concepts, it is necessary to realize that every math lesson is also a language lesson. Even, the results of research conducted by universities in UK as published in BBC [8] showed that the ability of reading and math ability is governed by the same gene. This is evidenced by approximately half the genes that affect the child's ability to read also play a role in the ability to learn mathematics.

Furthermore, Moursund [9] mentioned that writing developed by the Sumerians around 5,000 years ago. At the same time, the Sumerians developed several mathematical notations for writing. Writing and math are brain tool, both provide exceptional assistance to the human mind. The ability to use written language and mathematics is very useful to humans, because it is a "basic" in our formal education system. Similarly, Etsy cited in Moursund [9] stated that the mathematical results are expressed in a foreign language. Like other languages, it has its own grammar, syntax, vocabulary, word order, synonyms, negations, conventions, idioms, abbreviations, sentence structure, and paragraph structure. It has certain language features unparalleled in other languages, such as representation (for example, when

1 "x" is a dummy variable it may represent any real number or any numerical expression). The language also includes a large component of logic. The Language of Mathematics emphasizes all these features of the language.

A similar conviction demonstrated by Bertrand Russell cite in Bogomolny [10]. Russell recounted his experiences when he met Peano at an International Congress on Philosophy. Peano was one of the great mathematicians of the time. Russel was very impressed with the clarity and strength of arguments presented by Peano. He was always more precise than anyone else, and that he invariably got the better of any argument upon which he embarked, and it is always better than that indicated by others. Russell concluded that it must be owing to his mathematical logic. Then Russell studied all the works of Peano and his disciples. The conclusion become stronger that his notation afforded an instrument of logical analysis such as Russell had been seeking for years.

It seems clear that the relationship of mathematics and language not only on the existing mathematical vocabulary, but further than that. There is a strong relationship between the structure of language and mathematics, and also there is a strong logical relationship. Similarly, there is a strong relationship patterns and interconnected between language and mathematics.

Therefore, why mathematics become one of the compulsory subjects in all levels of schooling?. Besides of studying mathematics, people can be helped in solving simple arithmetic operation, so that people can easily do, even have a good understanding, on each financial transaction that they do. Then mathematics can also help a person in simplifying the complex issues at hand. Simplification is done by creating a model of the problem, so that the optimum solution can be determined more easily. Mathematics can also help people to practice so that they can think logically, critically and systematically. 2

Norfolk [11] asserts that mathematics builds logic and pattern recognition in the brain. The structure of math helps with organizational and problem-solving skills. By learning basic math skills, students learn to look at an entire problem before attempting to solve it. They learn to state the problem, come up with possible equations or possible ways to solve it, move step by step to come to a conclusion, and lastly, evaluate the final answer.

The importance of mathematics position in helping people training to be able to think with a good and systematic stage, has become one of the main bases why mathematics should be studied by humans. Indeed, the results of research showing that mathematics is positively contribute to a person indicated by Devlin [12] which asserts that 83% of high school students in the United States that follow the course of Algebra and Geometry managed to go to college, while students who do not learn it only stands at 36%. Much lower than students who learn mathematics. In fact, students who complete the Algebra and Geometry courses, showing achievements (in college) that is much better than his friends who did not.

Indeed, the ability to read, as described by Just et al, and Grabe et al cite in Ramelan [13] deals with two things: (1) the character of the text linguistic that must be mastered first (lower-level process), such as word recognition, beheading sentence, or the formation of semantic propositions; and (2) at a higher level process, the ability to read, describing the process of understanding related to skills in drawing conclusions or making inferences, capturing the essence of situational text, or the use of background knowledge. Both of these levels occur simultaneously and are related to the characteristics of the text and individual capacities. The main point is that a person's ability in understanding texts is also determined by the ability in making inferences, where this capability is based on the ability to think logically and systematically. This capability is closely related to mathematics.

METHOD

Albeit with different weights, studying mathematics was an activity that was already being experienced by students. Either when they were at school level or when they took a course on Basic Mathematics at the early semester. The difference lies only in the load/hours/credits that they have earned. Students with a science major background in high school have studied math a little more than those other majors. Similarly, mathematics students have studied mathematics with a load far more than that the other majors. Therefore, this study was classified as ex post facto study that is research conducted by studying variables that have occurred. Ex post facto study as confirmed by Widarto [14] is a research after the fact, the research conducted after the event occurred. The ex post facto study aims to discover the possible causes of behavioral changes, symptoms, or phenomena that have occurred.

9 The population of this research is all students of FKIP Universitas Mataram. While the sample was taken with a proportionate stratified random sampling technique. This technique was used because of the diverse and tiered population conditions. As Sugiyono [15] stated that this sampling technique is used when the population has members / elements that are not homogeneous and stratified proportionately. The sample size of this study was 204 students of fifth semester regular classes. Those samples were coming from each class of Indonesian students, Chemistry student,

Mathematics student, PGSD student, and Sociology student. The research instrument used in this study was Indonesian texts that meet the criteria of good texts, with the quality of the questions that can give an idea of the thinking ability of students. Therefore, the texts used have been analyzed and validated by linguists.

RESULT AND DISCUSSION

Developing Instruments

Instruments development was done to obtain the relevant instrument in measuring student abilities in understanding texts. This refers to Allen in Wiest [7] which concludes that students have a better ability to understand texts related to their everyday lives. The procedure was done in two stages, namely the development of the texts with their questions and then test expert. The process of development texts was done by selecting the text obtained from various sources, that their contents are relevant to the varying conditions of respondents. The topic should be familiar to students of all background courses. Similarly to the questions of the text, it was done the adaptation and modification, so that the questions are relevant to the student's ability. From the selection results, it was taken four relevant texts which then submitted to experts for doing the testing. From the test results expected to be obtained two pieces of texts that can be used for data retrieval.

The testing process involved Indonesian experts. The test results indicate that the texts were very suitable to use. In other words it's relevant instruments used for respondents from students. The test results as a basis to select the text used as an instrument.

Students' Competencies in Understanding Text

The results of research related to the students' competencies in understanding text are presented in three categories, namely data based on their department, data based on majors when they were in high schools, and result of regression analysis to cumulative achievement index (GPA) with score of understanding text. The first data is the primary data, while the second and third data are presented to confirm the first data. These three data are presented in the following order.

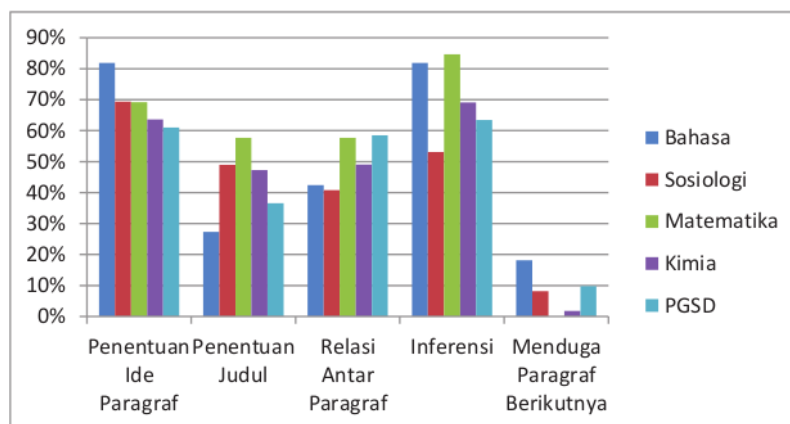


FIGURE 1. Students' Competencies in Understanding Text Based on Their Departments

The diagram above shows that in general students' competencies in understanding text are relatively similar. This can be seen from three things, namely: (1) almost all students can determine the paragraph idea well. It can be seen from the truth level above 60%; (2) almost all students have difficulties in predicting the main idea of the next paragraph. This is seen from the truth level below 20%; and (3) in spite of differences, students' competencies in understanding text related to determine the title, inter-paragraph relations, and making inferences are quite good.

However, compared to others, the competence of Indonesian students and Mathematics students is quite prominent. This is clearly seen in the diagram above. Indonesian students seem dominant in determining the basic

idea of paragraphs with answering abilities above 80%. The competence of Indonesian students in making inference is also very good, that is above 80%. Although this result is one level below the math student's result. Their competencies also seem dominant in terms of predicting the main idea of the next paragraph, although for this section, almost all students made mistakes.

The competence of mathematics students is very dominant in terms of making inferences, in defining the topic, also in determining the relationship between paragraphs. Even for these three categories, the competence of mathematics students is better than those of Indonesian students. Similarly, in terms of determining the main idea of paragraphs, the competence of mathematics students is quite good. This can be seen from their ability to answer that reaches almost 70%, although this is below the Indonesian abilities. Only on the predicting the idea of the next paragraph, the competence of mathematics students is lower than those others. Indeed for this question, almost all students are unable to answer it well.

To confirm the above results, an analysis of the students' background in learning mathematics was also done. As it is known that each major in high school learn math with slightly different weights. Therefore, checking the background in learning mathematics was seen by grouping students in term of their major in high school. The results are presented in the following diagram.

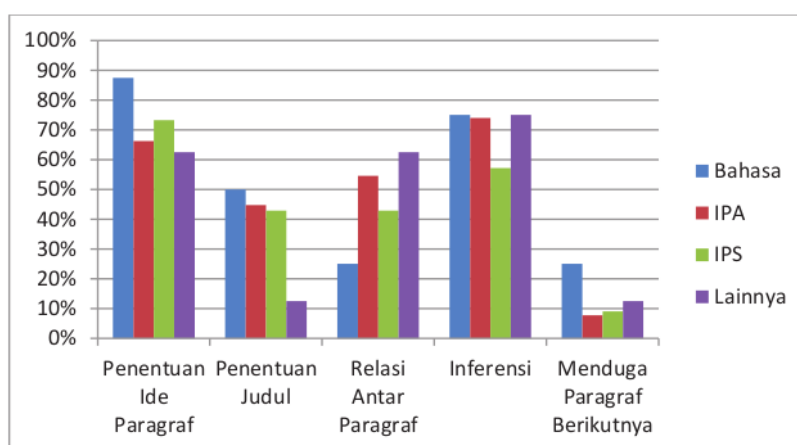


FIGURE 2. Students' Competences in Understanding Text Base on Their Major in SMA

From Fig. 2 above, it appears that students with a language background have better competence in understanding text almost for all points. Only on the point of determining the relationship between paragraphs, students with this background got the lowest level. The students with science background look good enough in making inference and in determining the relation between paragraphs. However, when viewed as a whole, the competence of students in understanding the text, based on the major background in high school, is relatively similar. This is seen with the similarity of scores obtained by those students. In other words, no student has dominant competence if it is viewed based on the major background.

Similarly, when the student's competencies in understanding text are analyzed based on the GPA. The GPA rating does not seem to have sufficient effect on the students' competencies in understanding text. This can be seen from the correlation value between the GPA with the student's score in answering all the questions of 0.1257, which means the relationship is very weak. This is reinforced by the regression analysis results between the two variables, where the results show that the influence of GPA variables is very weak against the second variable. The results of this analysis are shown in Fig. 3 below.

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.125700318
R Square	0.01580057
Adjusted R Square	0.010928295
Standard Error	21.04063277
Observations	204

ANOVA					
	df	SS	MS	F	Significance F
Regression	1	1435.683151	1435.683151	3.242955657	0.073222752
Residual	202	89427.06195	442.7082275		
Total	203	90862.7451			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	9.581048572	20.972181	0.456845598	0.648272911	-31.77142363	50.93352078
X Variable 1	11.03132087	6.125718167	1.800820829	0.073222752	-1.04723168	23.10987341

FIGURE 3. Regression Analysis Results between GPA and Score in Understanding Text

From the diagram above, it can be seen that the Multiple R=0.125700318 value indicates that the strength of the GPA variables in influencing the competence of text understanding is very low. This is also confirmed with SS Regression=1435.683151 values which far below the SS Residual=89427.06195 value. This confirms that the effect of the GPA score on text understanding scores is very small compared to other unspecified variables.

By considering the three results shown in the above three diagrams, it can be said that learning mathematics has relevance to the competence of students in understanding the text. Especially in the ability in making inferences, determining the relationship between paragraphs, and also defining the title of a text. The answers of those three types of questions are implicit, in the sense that the answers of those questions are not available directly to the text. This condition of course strengthens the explanation of Devlin [12] and also Norfolk [11] which asserts that **mathematics builds logic and pattern recognition in the brain**. A mathematical **structure** can help a person through the skills of organizing problems and solving them.

Those findings also confirm what Moursund explained [5] that mathematics and reading are two related materials. Similarly Greabell in Fite [6] which states that reading and mathematics share the same elements. Both are abstract, involving symbols, require cognitive processes, and both require knowledge of the interaction of various discrete skills. The above results also confirm that although language and mathematics differ in expressing their concepts, it is necessary to realize that every math lesson is also a language lesson [7]. However, of course the allegations related to the relationship still require deepening through further studies. However, of course, more detailed and in-depth explanations related to these findings are still very necessary.

CONCLUSION

The conclusion that can be drawn from this research is that there is a relation between students who learn mathematics with their competencies in understanding the text. However, this conclusion is still a kind of hypothesis that requires further justification. Therefore, research with wider and more diverse samples, research with more rigorous methodological, as well as continuous and systematic research, both to confirm and to deny the above results are still indispensable.

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