



Analysis of Students Mathematical Reasoning Ability in Solving Algebra Word Problems in terms of Learning Styles

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Abstrack

This study aims to describe students' mathematical reasoning abilities in solving algebra word problems in terms of learning styles. This type of research is descriptive qualitative research. The research subjects were class VII A students of SMPN 1 Pasrepan for the 2022/2023 academic year. The subjects in this study were 2 students with a visual learning style, 2 students with an auditory learning style, and 2 students with a kinesthetic learning style. Data collection techniques in this study were learning style questionnaires, mathematical reasoning ability tests, and interviews. Triangulation in this study uses triangulation techniques. The results of this study indicate that subjects with a visual learning style have high mathematical reasoning abilities with a percentage of 78.75%, subjects with an auditory learning style have high mathematical reasoning abilities with a percentage of 93.75%, and subjects with a kinesthetic learning style have reasoning abilities moderate mathematics with a percentage of 60%.

Keywords: *Mathematical reasoning ability, algebra word problems, learning styles.*

Abstrak

Penelitian ini bertujuan untuk mendeskripsikan kemampuan penalaran matematis siswa dalam menyelesaikan soal cerita aljabar ditinjau dari gaya belajar. Jenis penelitian ini adalah penelitian kualitatif deskriptif. Subjek penelitian adalah siswa kelas VII A SMPN 1 Pasrepan tahun ajaran 2022/2023. Subjek pada penelitian ini adalah 2 siswa dengan gaya belajar visual, 2 siswa dengan gaya belajar auditorial, dan 2 siswa dengan gaya belajar kinestetik. Teknik pengumpulan data pada penelitian ini adalah angket gaya belajar, tes kemampuan penalaran matematis, dan wawancara. Triangulasi dalam penelitian ini menggunakan triangulasi teknik. Hasil penelitian ini menunjukkan bahwa subjek dengan gaya belajar visual memiliki kemampuan penalaran matematis yang tinggi dengan persentase 78,75%, subjek dengan gaya belajar auditorial memiliki kemampuan penalaran matematis yang tinggi dengan persentase 93,75%, dan subjek dengan gaya belajar kinestetik memiliki kemampuan penalaran matematis yang sedang dengan persentase 60%.

Kata kunci: *Kemampuan penalaran matematis, soal cerita aljabar, gaya belajar.*

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Introduction

One of the compulsory subjects that must be given at all levels of education is mathematics, from elementary school to university. School mathematics can develop students to become logical, critical, creative, systematic, and analytical thinkers. According to Suherman (Feb, 2020), mathematics has an important role in life, because studying this knowledge can train ways of thinking in strategizing to deal with everyday problems. This indicates that mathematics also plays an important role in education. Recognizing these scientific disciplines, allows us to recognize a language for studying the universe and its contents. Mathematics is like a box containing thousands of tools with millions of uses. These tools are used by researchers in all disciplines to solve the problems they face in the world, from simple to complex problems.

One of the skills that students must have in learning mathematics is reasoning ability. According to Sadiq (2004) that reasoning is a thought process that seeks to connect known facts and evidence to a conclusion. In essence, reasoning ability is the ability to draw conclusions and assess the truth of an argument based on statements that have been proven true. Learning mathematics is understood through reasoning, and reasoning is trained through learning mathematics.

Adequate reasoning skills are required when solving narrative problems or story problems. This is because, in addition to getting answers to the questions asked and solving problems, students need to know and understand the steps involved in solving these problems. Nurjanah (2019) states that students with high reasoning abilities have a lower error rate when solving or solving problems. Most of the students had difficulties in solving math word problems using reasoning, including algebraic word problems. Sugondo (Nafi'an, 2011) states that math word problems are math problems that use verbal language and are generally related to everyday activities. So that appropriate learning strategies are needed to encourage students to be able to think actively and provide ideas and thoughts that can stimulate students' reasoning abilities. As stated by Russefendi in (Adibah, 2014), mathematics is formed from the results of human thought related to ideas, processes, and reasoning.

Table 1 Indicators of Students' Mathematical Reasoning Ability

No.	Reasoning Ability Indicator	Aspects Measured
1.	Make a guess	Students can determine the method or formula used in solving problems.
2.	Perform mathematical manipulation	Students can perform calculations or solve problems based on relevant methods so as to achieve the desired goals.
3.	Compile evidence and provide reasons for the truth	Students can compile evidence and give reasons for the truth is the ability of students to solve problems with models developed by students themselves.
4.	Checks the validity of an argument	Students can check the validity of an argument is the ability of students to check or re-examine answers from the validity of an argument.
5.	Draw a conclusion	Students can draw conclusions based on a number of data that have been observed and can also present it in written and oral form correctly.

In addition, the level of students reasoning abilities in understanding mathematics learning should also be different. This can be influenced by several factors, one of which is the student's learning style. Student success in achieving a learning goal is closely related to learning styles. Every student has a different learning style. Learning style according to David Kolb is a way of learning to focus students on processing information (Fatkhyyah, Winarso, & Benefits, 2019). Liberna (2018) on the other hand, argues that learning style is an approach that describes how students learn and process difficult or new information in different ways. Learning style is the way students absorb and develop information and knowledge. Learning styles can be divided into three styles, namely visual learning styles, auditory learning styles, and kinesthetic learning styles. Visual learning style is a learning style that relies on vision. Auditory learning style is a learning style that relies on hearing. Kinesthetic learning style is a learning style that involves movement. Each learning style has different characteristics and ways of learning. By knowing the learning style of each student, it will help them to absorb knowledge more easily.

Method

The approach used in this study is a qualitative approach, while the type of research used is descriptive qualitative research. The subjects in this study were class VII-A students of SMPN 1 Pasrepan, totaling 20 students who would be given a learning style questionnaire. After knowing each student's learning style, then from the results of the questionnaire, 6 students with a visual learning

style, 2 students with an auditory learning style, and 2 students with a kinesthetic learning style will be selected based on report cards and the results of discussions with the mathematics teacher. Then the subject will be given a mathematical reasoning ability test based on indicators of reasoning ability and also an interview. The instruments in this study were a learning style questionnaire, a mathematical reasoning ability test, and an interview guide. Prior to conducting the research, the three research instruments were consulted with the Supervisor. Then proceed with validating several experts, namely 2 Mathematics Lecturers and 1 Mathematics Teacher. The aim is to determine the feasibility of the three instruments.

Before collecting research data, the stages of selecting research subjects who meet the criteria are carried out. The first stage provides a learning style questionnaire consisting of 25 Likert questions. The second stage is checking the results and correcting student answers and categorizing students into their respective learning styles, namely visual, auditory, and kinesthetic learning styles. Student learning style questionnaire data can be seen in Table 2. After being categorized according to each learning style. The researcher chose 6 students as research subjects, namely 2 students with a visual learning style, 2 students with an auditory learning style, and 2 students with a kinesthetic learning style.

Table 2 Student Learning Style Questionnaire Results

No.	Learning Style	The Number of Students	Percentage
1.	Visual	12	60%
2.	Auditory	6	30%
3.	Kinesthetic	2	10%
Total		20	100%

In the next stage, the researcher conducted a mathematical reasoning ability test on the selected research subjects. The collected data were analyzed using three steps: 1) Data reduction; 2) Presentation of data; and 3) Drawing conclusions. The validity of the data in this study used a triangulation technique, namely using test and interview techniques. Then the data that has been obtained is analyzed to produce a conclusion.

Result and Discussion

Mathematical Reasoning Ability of Visual Learning Style Students

Students with visual learning skills have a fairly high maltematic reasoning ability with a percentage of 78.75%. Both subjects were able to complete the questions back, although not all of the questions were solved correctly. This is based on the acquired values, that is, subject V1 attains a value of 60 and subject V2 obtains a value of 90. Based on initial results, the reasoning used by students with visual learning skills is able to fulfill 4 indicators of reasoning ability with reverse, internally, that is, do the dugalaln, do the maltealtical malipullation, compiling evidence, and drawing conclusions. However, there is one indicator that is still lacking, namely checking the validity of an argument. Both subjects tended to be less thorough when doing their work, going back and forth in the calculation process.

The data that was obtained from the results of the test in the initial evaluation showed that students with visual learning skills were unable to understand all questions with feedback. Both subjects were unable to write down and were ashamed to explain what they knew in the memorized letters of the questions. Both of them were also unable to do the same thing, which was always a matter of resolving it with a return. Subjects who fulfilled the indicators stated that they were unable to express all the steps and then the formula that was rational was used to solve the problem.

In planning problem solving, both subjects were able to perform mathematical manipulations by making plans according to applicable rules. Both of them were also able to explain the steps used in solving the problem properly. Subjects with a visual learning style are also able to draw conclusions well. However, the two subjects were still unable to check the validity of an argument, this can be seen in the results of the interviews. When given the opportunity to check their answers again, both subjects were sure of what they were doing. Although there are still errors or deficiencies in the answer sheet.

Based on the description above, it shows that students with a visual learning style have a fairly high mathematical reasoning ability with a percentage of 78.75%. and the fulfillment of 4 indicators of reasoning ability including, making conjectures, doing mathematical manipulation, compiling evidence, and drawing conclusions. While the indicators that do not meet are checking the validity of an argument.

Mathematical Reasoning Ability of Auditorial Learning Style Students

The mathematical reasoning ability of students with an auditory learning style is included in the high category with the highest percentage gain, namely 93.75%. Both subjects were able to solve the questions properly and correctly. This is evidenced by the acquisition of the scores obtained, namely, subject A1 and subject A2 both received a perfect score of 100. Based on the test and interview results, both subjects were able to fulfill the five indicators at once, namely making conjectures, doing mathematical manipulation, compiling evidence, checking validity. an argument, and draw a conclusion.

Based on the data obtained from both initial and initial test results, it shows that both subjects were unable to understand the questions back. Both of them were unable to explain or even write down any informal information contained in the written questions, and returned them in full. Subject A11 and subject A12 were unable to provide an explanation of recognizing the known alphanuclear in the alpaca which was answered correctly in each question. Both of them also know the alps that are required to answer the questions, so that they can determine the alps strategies that are reasonable to use to solve these questions.

In the process of solving the problem, the two subjects were able to make mathematical manipulations properly according to the applicable rules. Both of them had no difficulty at all in doing or explaining each of the steps. Accordingly, the calculation process was passed properly and correctly. So that both of them get the final result that is correct for all the questions given.

Based on this explanation, it can be concluded that students with an auditory learning style have high mathematical reasoning abilities with a percentage of 93.75%. This is evidenced by the fulfillment of all indicators of mathematical reasoning ability properly, namely, making conjectures, performing mathematical manipulations, compiling evidence, checking the validity of an argument, and drawing conclusions.

Mathematical Reasoning Ability of Kinesthetic Learning Style Students

Students who have kinesthetic learning skills are included in the category of moderate mental ability with a percentage of 60%. The two subjects were still unable to complete the questions correctly. The initial acquired score, the K1 subject received a value of 30, while the K2 subject received an initial alluditorial learning ability as well as fulfilling 3 indicators of maltical reasoning ability , that is, doing suspicion, carrying out maltealtical malnipation, and analyzing conclusion. At the same time, both subjects were lacking in ability in 2 indicators of mental mathematical reasoning ability, compiling evidence, in examining the falsity of an argument.

Based on the mental calculations obtained from the results of the test as well as the initial ones, it can be seen that subjects with kinesthetic knowledge skills are unable to understand all the questions by simply going back. Both subjects were unable to explain the informality contained in the question,

nor were they able to explain the correct commands in the question. Although there are some informalities that are not included in the thick of the walkthrough. That way, both of them were able to compile the steps that would be used in the problem solving process.

From the given dual questions, both subjects had difficulty in solving question number 2. It was seen from the spreadsheet, at the end of the day both of them got the final result which was good. Apart from that, subject K1 also experienced difficulties with mental problems. If you look at the initial results, it shows that the two subjects are still not careful when calculating multiplication operations. The two of them also did not realize the frustrations that were contained in the delivery sheet when they were given the opportunity to check it again. Paldal salalt was asked to explain the steps, both of them also seemed a little confused.

Based on these explanations, it can be concluded that students with kinesthetic learning skills have moderate mental thinking skills with a percentage of 60%. Both subjects fulfilled 3 indicators, namely, doing suspicions, doing mal- mentaltical manipulation, and drawing conclusions. While the paldal indicators compile evidence in examining the falsity of an argument, both subjects are still classified as underprivileged.

Table 3 Results of the Achievement Assessment of Mathematical Reasoning Ability Indicators

Subject	Number	Score Each Indicator					Total	Average Score	Average Score of Each Learning Style
		1	2	3	4	5			
V1	1	3	3	3	3	4	16	13,5	15,75
	2	4	2	2	2	1	11		
V2	1	3	3	3	3	4	16	18	
	2	4	4	4	4	4	20		
A1	1	3	4	4	3	4	18	19	18,75
	2	4	4	4	4	4	20		
A2	1	3	3	4	3	4	17	18,5	
	2	4	4	4	4	4	20		
K1	1	3	2	2	2	1	10	10,5	12
	2	4	2	2	2	1	11		
K2	1	3	3	3	3	4	6	13,5	
	2	4	2	2	2	1	11		

Based on the table above, it can be seen that the average score of achievement indicators of mathematical reasoning ability is obtained by each learning style, that is, subjects with visual learning styles get an average score of 15.75, subjects with auditory learning styles get an average score 18.75, and subjects with kinesthetic learning styles get an average score of 12. Furthermore, these values will be converted into percentages to make it easier to know the level of mathematical reasoning ability of each subject.

Tabel 4 Percentage of Scores for Each Subject

Subject	Scores	Persentase	Kategori
V1	13,5	67,5%	Medium
V2	18	90%	High

A1	19	95%	High
A2	18,5	92,5%	High
K1	10,5	52,5%	Low
K2	13,5	67,5%	Medium

In the table above, it can be seen that the mathematical reasoning abilities of students with a visual learning style are included in the high category with a percentage of 78.75%. The mathematical reasoning ability of students with an auditory learning style is included in the high category with the highest percentage of 93.75%. And the mathematical reasoning abilities of students with kinesthetic learning styles are included in the category with a percentage of 60%. Related to this explanation, the following is the result of an analysis of students' mathematical reasoning abilities in terms of learning styles.

Table 5 Percentage of Scores for Each Learning Style

Learning Style	Score	Percentage	Category
Visual	15,75	78,75%	High
Auditory	18,75	93,75%	High
Kinesthetic	12	60%	Medium

Based on the mental analysis, it can be seen that the students' mental thinking skills with visual learning skills are included in the high category with a percentage of 78.75%. The mathematic reasoning ability of students with auditorial learning skills is included in the high category with the highest percentage, which is 93.75%. In students' mental thinking skills with thermal-kinesthetic learning skills including categories with a percentage of 60%. This is in line with the research results of Bire et al (2014) that there is an influence related to visual learning style, auditory learning style and kinesthetic learning style on student learning achievement.

Conclusion

Students with a visual learning style have high mathematical reasoning abilities with a percentage of 78.75%. And the fulfillment of 4 indicators includes making assumptions, doing mathematical manipulation, compiling evidence, and drawing conclusions, while the indicator that is not fulfilled is checking the validity of an argument. Students with an auditory learning style have high mathematical reasoning abilities with a percentage of 93.75%. This is evidenced by the fulfillment of all indicators of mathematical reasoning ability properly, namely, making conjectures, performing mathematical manipulations, compiling evidence, checking the validity of an argument, and drawing conclusions. Students with a kinesthetic learning style have moderate mathematical reasoning abilities with a percentage of 60%. Both subjects fulfilled 3 indicators of mathematical reasoning ability namely, making conjectures, doing mathematical manipulation, and drawing conclusions. Whereas in the indicators of compiling evidence and checking the validity of an argument, the two subjects are still relatively incapacitated.

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