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Analysis of Students' Errors in Solving Social Arithmetic Word Problems in terms of the Learning Styles

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ABSTRAK

Dalam menyelesaikan soal cerita diperlukan beberapa kemampuan, salah satunya yaitu kemampuan pemahaman kalimat dan simbol pada soal. Kemampuan siswa ini salah satunya dipengaruhi oleh gaya belajar. Gaya belajar dimaknai sebagai kecenderungan individu untuk menerima dan mengolah informasi dengan maksimal. Gaya belajar dikelompokkan menjadi tiga bentuk yaitu gaya belajar visual, auditori, dan kinestetik. Penelitian ini bertujuan untuk menganalisis dan mendeskripsikan bentuk kesalahan yang dilakukan siswa dalam menyelesaikan masalah soal cerita aritmetika ditinjau dari gaya belajar. Prosedur pengumpulan data pada penelitian ini yaitu pemberian angket gaya belajar, tes tertulis, dan wawancara. Subjek penelitian diambil 2 siswa kelas VII SMP Negeri 1 Malang dari masing-masing gaya belajar. Hasil analisis dari penelitian ini yaitu pada siswa dengan gaya belajar visual terjadi kesalahan pada tahap merencanakan penyelesaian, melaksanakan rencana penyelesaian dan tahap memeriksa kembali. Sedangkan siswa dengan gaya belajar auditori dan kinestetik terjadi kesalahan pada tahap memahami masalah, merencanakan penyelesaian, melaksanakan rencana penyelesaian dan tahap memeriksa kembali. Bentuk-bentuk kesalahan yang dilakukan terjadi pada semua gaya belajar.

Kata Kunci: kesalahan, menyelesaikan soal, soal cerita, gaya belajar

ABSTRACT

Some abilities are needed to solve word problems, one of which is the ability to understand sentences and symbols in the problem. One factor that affects the ability of each student is learning style. Learning style is a person's tendency to receive and process information to the maximum, learning styles can be grouped into three, namely visual, auditory, and kinesthetic learning styles. The purpose of this study is to analyze and describe the forms of errors made by students in solving social arithmetic word problems in terms of the learning styles. Data collection procedures in this study are giving learning style questionnaire, written test, and interview. The research subjects are two VII grade students at SMP Negeri 1 Malang from each learning styles. The results of the analysis of this research are that students with visual learning style error occurs at the step of devising a plan, carriying out the plan, and looking back. While students with auditory and kinesthetic learning style error occurs at the understanding the problem, devising a plan, carriying out the plan, and looking back. The error forms occur in all learning styles.

Keywords: errors, problem-solving, word problem, learning style

INTRODUCTION

As a result of learning mathematics at school, students are expected to have the ability to think logically and solve problems creatively, not just numeracy. This is in accordance with the spirit of Permendiknas No. 22 of 2006 (Depdiknas, 2006) [1] which states that mathematics lessons in schools aim to enable students to understand mathematical concepts, solve problems, create mathematical models and express ideas that are in the minds of students. To realize this goal, mathematics learning needs to include contextual problems that must be solved.

Robert W. Bailey (1989) [2] defined problem-solving as a combination of new ideas that use reasoning as a basis for combining ideas and leading to problem-solving. Problem-solving is an integral part of learning mathematics (McIntosh J. and O'Cannor M., 2014 [3]; Giganti, 2007 [4]; Aydoğdu M. and Ayaz M.F, 2008) [5]. According to

McIntosh J. and O'Cannor M. (2014) [3], problem-solving is so important because in real life, modern society and the world's civilization are always filled with problems, both small and big problems. By providing problem-solving in the learning process, it will make someone accustomed to facing and solving problems. According to Giganti (2007) [4], solving requires us to combine skills and concepts to deal with certain situations. If you have the ability of skills and concepts well, but are not able to use them together, you cannot learn to solve math problems well. Aydoğdu M. and Ayaz M.F (2008) [5] argue that problem-solving makes it easier for people to be able to adapt to certain situations. So that with problem-solving experience, a person can be more adaptive to the development of life in the world.

Problems in mathematics often take the form of word problems related to the context of everyday life. To be able to understand the problems presented in the story word problems, students are required to have the ability to translate them. At a higher level, students will be able to create mathematical models based on these problems and then solve them with mathematical concepts that they have mastered. According to Rahardjo and Astuti (in Hidayah, 2016) [6], word problems are a form of questions that can be used to assess students' abilities in learning, especially mathematics learning. Word problems in mathematics are usually made based on everyday life. Lesh R, 1981 [7] explains that problems related to real life must be meaningful and interesting for students so that students will find it easier to understand. However, Turmadi (2011) [8] found that there are still many students who have difficulty understanding and even solving word problems. This can be seen from the many errors or misconceptions students make when students solve problems in the form of word problems.

Paridjo (2002) [9] suggests several factors that cause students to make errors when asked to solve word problems, including: students do not understand the ideas in the questions and formulas, students do not understand arithmetic or algebra operations, students do not understand the relationship of ideas in questions with a formula that is in accordance with the problem, students do not understand the meaning of the questions (related to understanding symbols and sentences), students do not master the algorithm or procedure for solving a problem, students are not able to apply the formula appropriately. In fact, these abilities must be possessed by every student.

One of the factors that influence the lack of mastery of these abilities is the student's learning style. According to DePorter and Hernacki (2010) [10] learning style is a person's way to receive and process information optimally. If the teacher's delivery method and student learning styles are not suitable, students will find it difficult to accept the material and process it. Furthermore, DePorter and Hernacki [10] divided students' learning styles into 3 types, namely visual, auditory, or kinesthetic (V-A-K) learning styles. Students with visual learning styles tend to learn through what is seen, auditory students learn through what is heard, and kinesthetic students learn through movement and touch. This article focuses on analyzing students' errors in solving word problems based on their learning styles.

Several researchers have conducted studies related to learning styles (Widyaningrum, 2016 [11]; Firdaus, 2017 [12]; and Rosalina, 2018 [13]). Widyaningrum (2016) [11] examined student errors in working on math word problems on social arithmetic material based on student learning styles. The study concluded that the errors that students with visual learning styles tend to make are language interpretation errors, the errors that tend to be made by students with auditory learning styles are technical and language interpretation errors, and errors that tend to be made by students with kinesthetic learning styles are misinterpretation of language. Firdaus (2017) [12] explains that solving mathematical problems is influenced by learning styles, the tendency of each person to receive and process different information resulting in different errors. When a student gets learning, where the learning style is not in accordance with the teacher's teaching style, then the student will have difficulty understanding the material being taught. This also affects the form of errors that are made. Rosalina (2018) [13] in her research found that the selected visual, auditory, and kinesthetic subjects made errors at the same Newman stage, namely the transformation stage, the process skills stage, and the final answer writing stage. The studies mentioned above confirm that visual, auditory, and kinesthetic learning styles have an effect on the occurrence of student errors in solving math problems.

In this study, the Polya stage problem-solving will be used as a guideline for student error analysis. According to Sukayasa (2012) [14], Polya's problem-solving stages have stages and activities in each stage that are not complex and uncomplicated, so research related to problem-solving often uses the Polya stage. According to Polya (1988) [15] the steps in solving the problem are: (1) understanding the problem, (2) plan problem-solving, (3) implement a problem-solving plan, and (4) looking back. This study aims to analyze and describe the form of errors made by students in solving social arithmetic word problems in terms of learning styles.

METHOD

This research used a qualitative research approach with descriptive research type. Sukmadinata (2005) [16] explains that qualitative research is a form of research that aims to analyze and provide an overview of the attitudes, beliefs, views, or thoughts of people both individually and in groups. The research was conducted in class VII SMP Negeri 1 Malang. Researchers conducted learning style tests and written tests to select research subjects. After the learning style test is carried out, students will be given a written test in the form of social arithmetic word problem. Furthermore, 2 students each from each learning style will be selected to be the research subjects. The subject selection is not only based on learning styles, but also based on the results of students' completion of the social arithmetic word problem given and also good communication skills to facilitate the interview stage.

The data in this study are in the form of learning style test results data, written test results data about social arithmetic word problem, and interview data. Meanwhile, the data collection techniques used were learning style tests, written tests on social arithmetic word problem, and interviews.

The data analysis was carried out according to the opinion of Miles and Huberman. Miles and Huberman (1994) [17] state that the process of analyzing data requires three stages, namely: (1) reducing data, (2) presenting data, and (3) drawing conclusions and data verification. In this study, drawing conclusions is the final stage of data analysis. Conclusion drawing has the aim of describing the forms of errors made by students in solving arithmetic word problem based on Polya's stages.

RESULTS AND DISCUSSION

In this study, students will analyze the forms of errors when solving arithmetic word problem. The following are indicators of the forms of errors that students may make in solving word problem based on Polya's stages. The indicators of these error forms were developed by researchers and adapted to social arithmetic material. Indicators of the forms of student errors when solving arithmetic word problem based on Polya's stages can be seen in Table 1 below.

Table 1. Indicators of the forms of student errors based on the Polya stages

Type of Errors	
Errors in understanding the problem	Errors in determining what information is known
	Did not write down the complete known information
	Errors in determining what to ask
	Did not write down the complete known information
Errors in planning problem-solving	Error in determining the settlement plan
	Did not write down a specific completion plan
Errors in implementing a problem-solving plan	Errors in solving problems according to the plans made
	Calculation errors in the steps that have been compiled
	Errors in using mathematical signs or symbols
	Carry out the wrong settlement plan
Errors in looking back and checking the solutions that have been obtained	Did not double-check the results obtained
	Did not write down a summary answer
	Errors in concluding answers

Researchers collected data from 9 February 2020 to 14 February 2020. Questionnaires for classifying learning styles were given to 28 students of class VII C and 28 students of class VII B at SMP Negeri 1 Malang with a processing time of 25 minutes. The questionnaire contains 16 numbers, each with three answer choices. The learning style questionnaire was adopted from Irina Mihaela Stanescu (2017) [18]. The results of the questionnaire are used to determine the types of learning styles that students have

After working on the learning style questionnaire, the researcher asked the students to do the written test questions. The test question instrument contains 4 social arithmetic word problem. After obtaining the results of the students 'answers, the researcher classifies students' answers according to the visual, auditory and kinesthetic learning style groups. In grouping these answers, each group of learning styles will be taken by two students with answers that have errors and their learning style scores tend to be high. Furthermore, interviews will be conducted with selected subjects. The selected subjects can be seen in Table 2 below.

Table 2. Subject Selection

No	Student Initials	Learning Styles Tend	Subject Code
1	CF	Visual	SV_1
2	MRD	Visual	SV_2
3	MYPH	Auditory	SA_1
4	INNYR	Auditory	SA_2
5	ARRM	Kinesthetic	SK_1
6	MZRH	Kinesthetic	SK_2

Comparison of Student Errors Based on Learning Styles

From the results of the analysis of the visual, auditory, and kinesthetic subject completion, it can be seen the comparison of the form of the error that the subject might make. Subjects with visual learning styles did not experience

errors at the stage of understanding the problem, subjects with visual learning styles were able to understand well the information on the questions. This is in line with the opinion of DePorter & Hernacki (2010) [10] which states that one of the characteristics of a person with a visual learning style is that they enjoy reading and are easier to understand what they see. For subjects with auditory and kinesthetic learning styles, there are errors at the stage of understanding the problem, namely being unable to fully explain the information contained in the questions. At the stage of plan problem-solving, all subjects, both visual, auditory and kinesthetic, experience the same error, namely not choosing the completion plan correctly, in addition there are those who are unable to explain the complete plan for completion.

At the stage of implement a problem-solving plan, almost the same errors occurred in visual, auditory and kinesthetic subjects. These errors are in the form of wrong in the calculation process, wrong in using mathematical symbols, and carrying out the wrong plan or strategy so that the process is also wrong. In the last stage, namely the stage of looking back and re-checking the results obtained, the form of errors that occur in the visual subject, namely not checking the completion again and the written conclusion there is an error. For auditory and kinesthetic, subjects the errors that occur are almost the same, namely the written conclusions have errors, do not write down the conclusions of the answers and do not double-check the completion process. The comparison of subject errors based on these learning styles can be seen in table 3 below.

Table 3. Comparison of error forms based on learning styles

Polya Stages	Visual Subject	Auditory Subject	Kinesthetic Subject
understanding the problem	-	• Not able to explain the information in the questions completely	• Not able to explain the information in the questions completely
Plan problem-solving	• Errors in choosing a settlement plan	• Errors in choosing a settlement plan • Not able to explain the completion plan well	• Errors in choosing a settlement plan • Not able to explain the completion plan well
Implement a problem-solving plan	• Miscalculation in the steps that have been prepared • Errors in using of mathematical signs or symbols • Carry out the wrong settlement plan	• Miscalculation in the steps that have been prepared • Errors in using of mathematical signs or symbols • Carry out the wrong settlement plan	• Miscalculation in the steps that have been prepared • Errors in using of mathematical signs or symbols • Carry out the wrong settlement plan
Looking back	• Did not re-check the results obtained • Errors in concluding answers	• Did not re-check the results obtained • Did not write down conclusions on answers • Errors in concluding answers	• Did not re-check the results obtained • Did not write down conclusions on answers • Errors in concluding answers

The following is an example of the results of visual student's work in solving word problem about tax and discount in Figure 1.

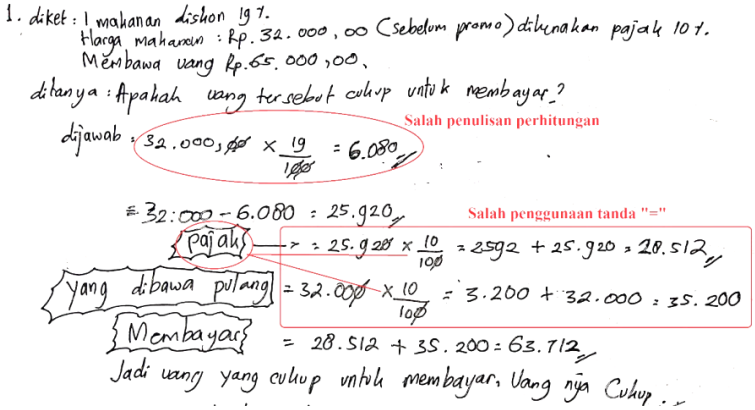

Figure 1. Students' work results in a visual learning style

Based on the results of student's work and the results of interviews with students with a visual learning style, it can be seen that the information written by students is structured, but there is some information that is incomplete, but can be completed during the interview. This is in accordance with the research of DePorter & Hernacki (2008) [19] which concluded that students who have a visual learning style tend to often not record information that is actually important even though these students have a neat, orderly nature and use visual illustrations but are different in terms of receiving verbal information. Errors made occur at the stage of implement a problem-solving plan. At the stage of implement a problem-solving plan, visual students make errors in the calculation process and make errors in using mathematical symbols. Meanwhile, at the stage of plan problem-solving and looking back, it can be explained well by students visually at the time of the interview.

An example of the results of auditory student's work in solving word problem about tax and discount can be seen in Figure 2.

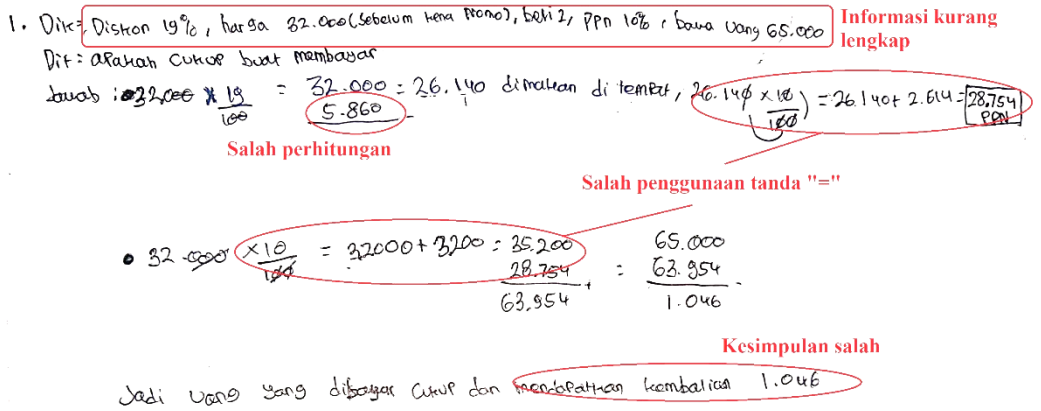

Figure 2. Student's work results in an auditory learning style

Based on the results of student work and the results of interviews with students with an auditory learning style, the errors made by students were at the stage of understanding the problem, implement a problem-solving plan, and looking back. At the stage of understanding the problem, auditory students are unable to write or explain properly the information obtained from the word problem. At the stage of implement a problem-solving plan, the auditory student made the wrong calculation process and used the wrong mathematical symbol, while at stages of looking back, the auditory student did not check the results of their work, so there were still errors in the answers and conclusion

An example of the results of the kinesthetic student's work in solving word problem about tax and discount can be seen in Figure 3.

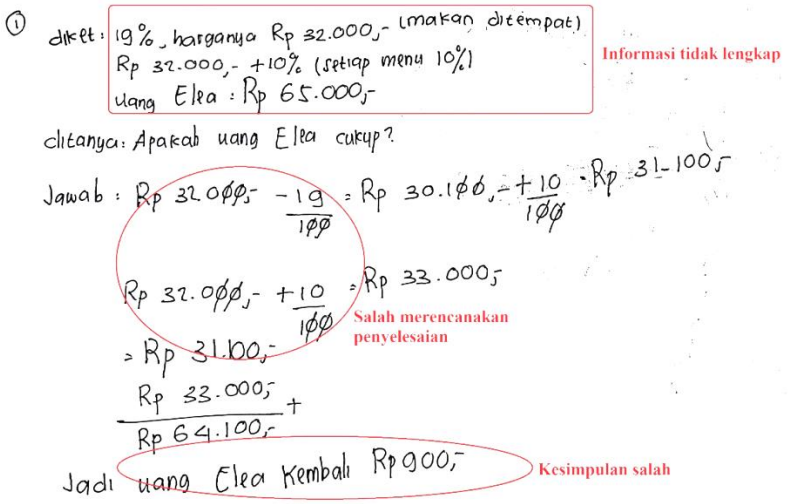

Figure 3. Student's work results in a kinesthetic learning style

Based on the results of student's work and the results of interviews with students with a kinesthetic learning style, the errors that students made when solving word problem about taxes and discounts are at the stage of understanding the problem, planning problem-solving, implementing a problem-solving plan, and looking back. At the stage of understanding the problem, kinesthetic students are not able to write down or explain the information

obtained completely. At the stage of problem-solving plan, kinesthetic students do not have the ability to plan the solution correctly, so at the stage of problem-solving plan it is also wrong, because the plans made have errors. This is in accordance with the opinion of Soejono (1984) [20] that one of the reasons students find it difficult to solve problems is because students choose irrelevant principles or strategies. At the stage of looking back, kinesthetic students do not double-check the result of their work, so that the answers made still contain errors.

CONCLUSION

Based on the results of the error analysis of class VII students of SMP Negeri 1 Malang in solving social arithmetic word problem in terms of student learning styles, it was found that students with visual learning styles made errors at the stage of plan problem-solving, implement a problem-solving plan and looking back. Meanwhile, students with auditory and kinesthetic learning styles have an error at the stage of understanding the problem, plan problem-solving, implement a problem-solving plan and looking back. The forms of errors that were made occurred in all learning styles, the researcher did not find any significant differences in the forms of errors made by students with visual, auditory and kinesthetic learning styles in solving social atimatics word problem according to Polya's stages.

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