

ANALYSIS OF MATHEMATICS PROBLEM SOLVING DIFFICULTY ON MAIN MATTER OF OPPORTUNITY

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Abstract

This study aims to describe and analyze the difficulty of solving mathematical problems on the material of opportunity when viewed from the learning style of students. This research is a type of qualitative research. The method used in this study is a learning style questionnaire, mathematical problem-solving ability tests, interviews and, documentation. Based on the results of research and discussion, it was concluded that Students with visual learning styles had difficulties at the stage of understanding the problem, the stage of determining the completion plan, and the stage of re-examining the solution; Learners with auditory learning styles have difficulties at the stage of understanding the problem, the stage of determining the completion plan, and the stage of re-examining the settlement; Students with a kinesthetic learning style have difficulties at the stage of understanding the problem, determining a settlement plan, implementing a settlement plan, and re-examining the solution

Keywords: Problem, Solving, Learning, Opportunity

INTRODUCTION

The results of the 2015 Trends in International Mathematics and Science Study (TIMSS) in Hadi (2019), Indonesia was ranked 44th out of 49 countries with an average score of 397. While the results of the 2018 Program for International Student Assessment (PISA) survey in Tohir (2019), Indonesia was ranked 74th out of 79 registered countries with an average score of 371. Based on these data, Indonesia is still at the lowest level in the fields of mathematics and science. It can also be said that in the field of mathematics and science at the school level in Indonesia the proportion is still very low.

According to Prabawa (2017) states that mathematics plays an important role in the development of science and technology, not only can it be used as a tool that is applied in other disciplines, but also as a means of logical, critical, and systematic thinking. In Laela et al. (2018), the National Council of Teachers of Mathematics formulates the objectives of learning mathematics as follows: a) Learning to communicate (mathematical communication); b) Learning to reason (mathematical reasoning); c) Learning to solve problems (mathematical problem solving); d) Learn to link ideas (mathematical connections); e) Formation of positive attitudes toward mathematics (positive attitudes toward mathematics). Based on the description above, it can be concluded that mathematics plays a very important role in everyday life, therefore mathematics must be given to students so that students can think logically, analyze, systematically, critically, and creatively and work together.

In the learning process, it is not uncommon for teachers and students to encounter a problem, one of the problems often experienced by students in solving math problems, as stated by Mr. Wiyarna as a mathematics teacher at SMA N 3 Tegal. Skemp in Tias & Wutsqa (2015) argues that solving mathematical problems depends on students' understanding of mathematical variables. From these various alternative solutions, students are required to be more creative in expressing and using knowledge (understanding) to solve mathematics. There are 4 stages of problem-solving according to Polya in Prabawa (2017), namely a) Understanding the problem; b) Devising a plan; c) Carrying out according to plan; d) Looking back).

In Pak Wiyarna's opinion, when students work on math problems together there is no apparent difficulty, but when working independently, there are difficulties. This is influenced by the different learning styles of students. When students solve math problems independently, the results will vary depending on the learning style of each student. This is reinforced by research by Rofiqoh et al. (2016) that of the 32 students studied have different learning styles, which have an impact on the stages of solving mathematical problems.

According to Sundayana (2018), each student has a different learning style. As also explained by Hamzah B. Uno that "the proverb says different fields, different fish. Different people, different learning styles." The proverb is suitable to explain situations where everyone's learning style is different.

According to Khosiyah (Nuriyani & Suwandono, 2018), learning style is how everyone absorbs new information, how to concentrate, process, and accommodate the information that enters the brain. According to Fleming and Mills in Wassahua (2016), learning style is a trend where students tend to adopt certain strategies in learning, one form of responsibility, a learning method can be obtained according to the learning needs in the classroom/school and subjects. According to Deporter & Hernacki in Sundayana (2018), there are three kinds or types of learning styles, namely visual learning styles, namely learning styles that rely on visual acuity to be able to understand and remember information; auditory learning style, namely learning style by relying on hearing acuity; and kinesthetic learning styles require individuals who learn to touch something that provides certain information to remember it.

Based on the background, the purpose of this study is to describe and analyze the difficulty of solving mathematical problems of students at SMA N 3 Tegal on the material in terms of learning styles.

METHOD

This research was conducted at SMA N 3 Tegal which is located at Jl. Sumbodro No.81, Slerok, District. East Tegal, Tegal City, Central Java. The study was conducted for 14 days starting on March 10' 2021 until March 24, 2021. The approach used in this study is a qualitative research approach. The research subjects in this study were students of class 12 MIPA 3. The data sources in this study came from learning style questionnaires, mathematics problem-solving ability tests, interviews, and documentation at the time of the study.

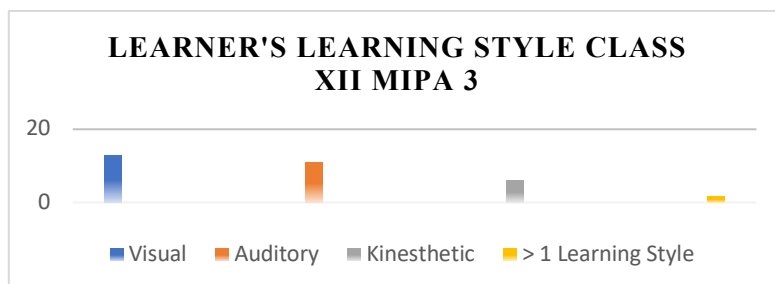
RESULT AND DISCUSSION

Result

Based on the results of the questionnaire on the learning styles of students in class XII MIPA 3, it shows that there are 13 students with visual learning styles, 11 students with auditory learning styles, 6 students with kinesthetic learning styles, and 2 students who have more than

one learning style. The following is a diagram of the learning styles of 12th-grade students of SMA N 3 Tegal.

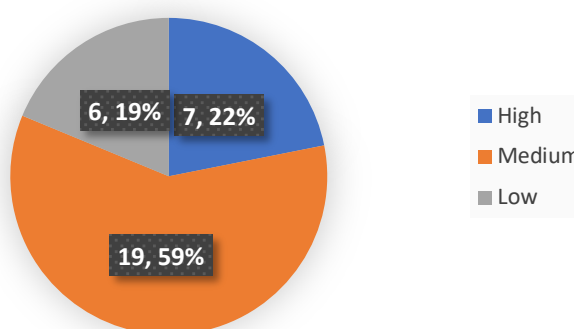
Diagram 1. Learning Style of Class XII MIPA 3 Students at SMA N 3 Tegal



Based on the diagram above, shows that the learning style of students in class XII MIPA 3 SMA N 3 Tegal is dominant in the visual learning style. Furthermore, students are given a test of mathematical problem-solving skills on the material of opportunity. The test results were then grouped into 3 groups consisting of high, medium, and low CAR test results. The following is a diagram of the results of the mathematics problem-solving ability test for students of class XII MIPA 3.

Diagram 2. Mathematical Problem Solving Ability Test Results

TEST RESULT MATHEMATICS TROUBLESHOOTING ABILITY



Determination of research subjects using a purposive sample technique that is based on the results of learning style questionnaires and tests of mathematical problem-solving abilities. From each learning style, 3 research subjects were taken which consisted of the high, medium, and low math problem-solving ability test results. To determine the research subject, first determine the average in each group of math problem-solving ability tests. Furthermore, the determination of research subjects by choosing a learning style that has a total score on test results that is close to the average in each group of test results. The following are the average KPMM test results in each group.

Table 1. Average KPMM Test Results

KPMM Test Results	Average
High	89,39
Medium	55,10
Low	37,37

The following are the research subjects in this study.

Table 2. List of Research Subjects

Code Name	Learning Style	KPMM Group	Subject Code
A-20	Visual	High	1-VT
A-25	Visual	Medium	2-VS
A-24	Auditory	High	3-AT
A-9	Auditory	Medium	4-AS
A-19	Auditory	Low	5-AR
A-23	Kinesthetic	High	6-KT
A-26	Kinesthetic	Medium	7-KS
A-15	Kinesthetic	Low	8-KR

Discussion

In this study, the difficulty of solving mathematical problems in terms of visual, auditory, and kinesthetic learning styles was investigated. The following is the tendency of students' mathematical problem-solving difficulties for each of these learning style categories, namely as follows.

Table 3. The tendency of difficulties experienced by students from the type of learning style.

No	Learning style	Difficulties experienced by students
1.	Visual	Understand the problem, determine a resolution plan, and re-examine the solution.
2.	Aditory	Understand the problem, determine a resolution plan, and re-examine the solution.
3.	Kinesthetic	Understand the problem, determine the resolution plan, implement the settlement plan and re-examine the solution.

From the results of tests and interviews, 2-VS subjects had difficulties at the stage of understanding the problem because what was known and what was asked in the problem was not by following what was the problem in the question. This is shown in the results of the KPMM test at number 3. It should be at number 3 that it is known that the number of students is 20 and the opportunity to be ranked 1 is $n(J) = 1$, then what is asked in this problem is the opportunity for Andi to be ranked 1. To solve this problem, you can use the formula for the probability of a complement where the final result or the probability of Andi being ranked 1 is 0.95. However, the results of the 2-VS subject KPMM test show that the final result or Andi's chance to be ranked 1 is 20. This is also reinforced by excerpts from interviews that have been conducted with 2-VS subjects. The following is an excerpt from the interview.

2-VS : “Untuk nomor 3, saya tidak terlalu paham dengan permasalahannya bu. Saya hanya menjawab $\frac{n(S)}{n(A) \times n(S)} = \frac{20}{20 \times 1} = 20$ nya 20 lalu S nya 1. Dan rumus $\frac{n(S)}{n(A) \times n(S)} = \frac{20}{20 \times 1} = 20$. Kesimpulan untuk nomor 3 itu mungkin peluang Abdul mendapatkan peringkat 1 dari 20 siswa.”

From the results of the interview, it is clear that the 2-VS subject does not understand the problems presented. The 2-VS subject also had difficulties at the stage of understanding the

problem presented in number 4. The following are the results of the 2-VS subject test. The results of the interviews that have been carried out show that the 2-VS subject does not understand what is the problem in number 4. The following is an excerpt from the interview.

- P : “Pada nomor 4 itu yang ditanyakan peluang mendapatkan bola berwarna putih atau merah atukah peluang mendapatkan bola berwarna putih dan merah?”
2-VS : “Peluang untuk mendapatkan bola berwarna putih dan peluang mendapatkan bola berwarna merah.”

The problem with the correct number 4 is the opportunity to get a white or red ball. The 2 questions show that the 2-VS subject has difficulty at the stage of understanding the problem.

According to Alexander (Widyaningrum & Pd, 2016), "Visual learners have qualities that many teachers favor: Nearness, good organizational skills, and a creative side. On the other hand, they usually do not take notes very well and will do better with remembering information featured in pictures. Spelling tests are an easy task with this type of learner but do not expect them to do so well with verbal information". This is by following the visual learning style indicator according to Deporter & Hernacki (Sundayana, 2018), namely that students with a visual learning style are neat and orderly, but have problems remembering verbal instructions.

In Widyaningrum & Pd (2016), Alexander provides solutions for students with visual learning styles to be able to solve mathematical problems in the form of story questions, namely as follows:

- a. Given them illustration
The illustrations shown here are diagrams, shapes, and images that can be used to represent the main components by removing that which is distracting from the story problem.
- b. *The KNWS – Know, Not, What, Strategy*
KNWS helps students in categorizing things in the problem, namely what is known, what is not related or irrelevant to the problem, what they want to find from the story problem and what strategies they use to solve the story problem from the known information.
- c. *Use Graphic Organizer Software*
Graphic Organizer is a software program that students can use to solve math story problems and learn to find the plot of the story problem. This software teaches students how to solve problems from easy to difficult.
- d. *Translating and Highlighting*
Students know the keywords that can make it easier to solve math story problems. This strategy is taught in a short time by making notes on the blackboard so that students can record them in notebooks. Then separate the notes into categories of mathematical operations.
- e. *Choosing a Strategy*
Using various strategies that are suitable for students with visual learning styles, especially using techniques that can affect the sense of sight.

Subjects 2-VS also had difficulties at the stage of determining the settlement plan in question number 5. The settlement plan was not by following what was known and what was asked. This is reinforced by the results of interviews that have been conducted. The following is an excerpt from the interview.

- 2-VS : “Untuk mata dadu angka ganjil itu sendiri kan diambil dari A1, A2, A3, A4, A5, A6, yang ditanya mata dadu angka ganjil jadi A1, A3 dan A5 itu ada 3. Lalu peluangnya itu sendiri masuk ke rumus $\frac{n(A)}{n(S)} = \frac{3}{12}$ Nah dari hasil $\frac{3}{12}$ itu saya bagi

3 semua, lalu ketemu hasilnya $\frac{1}{4}$. Yang kedua, gambar uang logam sendiri itu kan dari G1, G2, G3, G4, G5, G6. Uang logam itu sendiri ada 6. Lalu masuk ke rumus dengan peluang $\frac{n(A)}{n(S)} = \frac{6}{12}$. Dari situ dibagi 6, ketemu $\frac{1}{2}$,

The settlement plan carried out by the 2-VS subject is not by following what was asked in question number 5. In addition, the 2-VS subject with a visual learning style also has difficulties at the stage of re-examining the settlement because the conclusions given are not by following what is the problem. This is reinforced by the test results and the results of interviews with 2-VS subjects in numbers 3, 4, and 5 where the 2-VS subjects were able to provide conclusions by following the completion plan and the results obtained from implementing the settlement plan but not by following what was asked. . This is by following the results of Argarini's research (2018) which shows that students with visual learning styles cannot look back at answers. According to Indrawati in Argarini (2018), visual subjects did not re-check the questions presented.

Figure 4. KPMM Test Results Subject 4-AS Number 5

$S = \{1, 2, 3, 4, 5, 6\}$
 $A = \{1, 3, 5\}$ mata dadu angka ganjil
 $n(A) = 3$
 $P(A) = \frac{n(A)}{n(S)} = \frac{3}{6} = \frac{1}{2}$
 $B = \{G1, G2, G3, G4, G5, G6\}$ gambar paku uang logam
 $n(B) = 6$
 $P(B) = \frac{n(B)}{n(S)} = \frac{6}{12} = \frac{1}{2}$
 $A \cap B = \{G1, G3, G5\}$
 $n(A \cap B) = 3$
 $P(A \cap B) = \frac{n(A \cap B)}{n(S)} = \frac{3}{12} = \frac{1}{4}$
 $P(A \cup B) = P(A) + P(B) - P(A \cap B) = \frac{1}{2} + \frac{1}{2} - \frac{1}{4}$
 $= \frac{2+2-1}{4} = \frac{3}{4}$

Figure 4 is the result of the 4-AS subject KPMM test with auditory learning style. Based on the results of tests and interviews that have been carried out, it shows that 4-AS subjects with auditory learning styles have difficulties at the stage of understanding the problems presented in number 5. The problems presented in number 5 are the probability of appearing odd number dice and images on coins and coins. The correct answer is the probability that the dice will appear in odd numbers and the image on the coin is 1/4. However, in the KPMM test results above, the answer given by the 4-AS subject is 3/4. This is also reinforced by the results of interviews that have been conducted. The following is an excerpt from the interview.

4-AS : “Alhamdulillah saya memahaminya. Yang diketahui yaitu sebuah dadu dan sekeping uang logam dilemparkan bersama. Yang ditanya peluang kejadian mata dadu dengan angka ganjil atau peluang kejadian gambar pada uang logam.”

Based on the interview excerpt, according to the 4-AS subject who was asked in question number 5, namely the probability of the occurrence of dice with an odd number or the probability of the occurrence of a picture on a coin. Even though the real problem in question number 5 is the probability of an odd number of dice appearing and a picture on a coin and can be solved using the formula for the probability of independent events.

Figure 5. KPMM Test Results Subject 4-AS Number 6

$P(A) = 0.7$
 $P(B) = 0.8$
 $P(A \cap B) = 0.7 \cdot (1 - 0.8)$
 $= 0.7 \cdot 0.2$
 $= 0.14$

Subject 4-AS also had difficulties at the stage of determining the settlement plan to solve the problem in number 6. Based on the results of tests and interviews that had been carried out, subject 4-AS determined that the settlement plan was not by following what was known and what was asked in number 6. The following excerpts of an interview with the subject 4-AS.

4-AS : “Cara menyelesaikannya yaitu dengan menggunakan rumus peluang suatu kejadian saling bebas dan peluang kejadian tidak saling bebas atau bersyarat. Dan rumus peluang A dan peluang B $\boxed{= \frac{\text{peluang A} \times \text{peluang B}}{\text{peluang A}}}$ dengan peluang A adalah $\frac{\frac{7}{10} \times 0,8}{0,7}$, jadi hasilnya adalah $\frac{8}{10}$ ”

Based on the interview excerpt, it is clear that the 4-AS subject was unable to determine the settlement plan according to what was known and what was asked in question number 6. In addition, the 4-AS subject had difficulties at the stage of re-examining the settlement in questions number 5 and 6. Although the results of the interview showed that the 4-AS subject was able to provide conclusions by following the settlement plan and the results obtained from implementing the settlement plan, it was not by following what was asked.

Suggestions and solutions that can minimize difficulties that result in errors in students with auditory learning styles can come from teachers as educators and students according to Widyaningrum & Pd (2016), namely as follows a) changing voices when delivering subject matter such as intonation, the volume of sound and speed, b) repeating the concepts that have been given, c) forming small groups consisting of several students, the small groups are used to review the subject matter, and d) turn on music when students start to feel bored. While the student activities that can be done are discussing with friends who better understand the material and listening to recordings of the subject matter.

Based on the results of tests and interviews that have been carried out, it shows that 8-KR subjects with kinesthetic learning styles have difficulties at the stage of understanding the problems in numbers 3 and 6 because the KPMM test results are clear that 8-KR subjects do not solve the problems presented in numbers 3 and 6 This is confirmed in the results of the interview. The following is an excerpt from the interview.

P : “Oke. Di nomor 3, kamu mengalami kesulitan dibagian mana?”

8-KR : “Sebenarnya saya tidak dapat menjabarkannya bu dan disitu saya tidak mengerti sama sekali akan soalnya.”

Based on the quote above, it shows that the 8-KR subject has difficulty at the stage of understanding the problem presented.

Figure 6. KPMM Test Results for Subject 8-KR Numbers 4 and 5

4. Putih = 2 $n(S) = 12$
 Hitam = 2
 $n(H) = 2$
 $n(W) = 2$
 • Peluang putih = $\frac{n(W)}{n(S)} = \frac{2}{12}$
 • Peluang hitam = $\frac{n(H)}{n(S)} = \frac{2}{12}$

5. $n(S) = 6 \times 2 = 12$
 $S = \{A_1, A_2, A_3, A_4, A_5, A_6, B_1, B_2, B_3, B_4, B_5, B_6\}$
 • Peluang berbeda warna = $\frac{n(A)}{n(S)} = \frac{6}{12} = \frac{1}{2}$
 • Peluang sama warna = $\frac{n(B)}{n(S)} = \frac{6}{12} = \frac{1}{2}$

In addition, the 8-KR subject also had difficulties at the stage of determining the settlement plan in numbers 4 and 5. The settlement plan provided was not by following what was known and what was asked in the problem.

Subject 8-KR also had difficulty at the stage of rechecking the completion. Based on the results of the KPMM test and interviews that have been carried out with the 8-KR subject, it shows that the 8-KR subject can provide conclusions by following the completion plan and the results obtained from implementing the settlement plan but are not by following what was asked. This research is relevant to the research of Cahyono & Sudia (2019) which shows that the kinesthetic learning style has difficulties at the stage of implementing a problem-solving plan and re-examining the solution.

Suggestions or solutions that can minimize student errors with kinesthetic learning styles that can be done by teachers and students according to Widyaningrum & Pd (2016) are a) using visual aids, teaching aids, or media that can be seen, touched, and manipulated by students when they learn to stimulate curiosity, b) get used to standing or sitting next to students when guiding students individually, c) allowing students to do movements that can help students understand the lesson, and d) using real concept simulations. In addition, activities that can be carried out by students are learning by using teaching aids and often practicing finding their problem-solving strategies without having to memorize the standard formula.

CONCLUSIONS AND SUGGESTIONS

Based on the results of the research and discussion above, it is concluded that each learning style has its difficulties in solving mathematical problems, including students with visual learning styles having difficulties at the stage of understanding the problem, the stage of determining the completion plan, and the stage of re-examining the solution; students with auditory learning style have difficulty at the stage of understanding the problem, the stage of determining the completion plan, and the stage of re-examining the settlement; and students with kinesthetic learning styles have difficulties at the stage of understanding the problem, determining a settlement plan, implementing a settlement plan, and re-examining the solution. Based on the conclusions above, the suggestions that researchers can convey are as follows:

1. The teacher can provide mathematical problems as an exercise for students so that students are familiar with the form of mathematical problems.
2. Students are expected to always hone their skills in solving mathematical problems by working on problem-solving problems.
3. Teachers are expected to monitor students more so that they can find out the difficulties of each student in mathematics.
4. Teachers are expected to know the learning styles of each student as an ingredient in determining learning strategies.

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