

## DESCRIPTION OF MATHEMATICS PROBLEM SOLVING ABILITY IN TERMS OF LEARNING STYLE

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### Abstract:

This study aims to describe and determine students' abilities to solve mathematical problems that focus on visual and auditory learning styles. Subjects are eighth-grade students from junior high school in Bulukumba district. This research is descriptive qualitative, which seeks to determine and describe the mathematical problem solving ability in terms of student learning styles. Data is collected using questionnaires, tests, and interviews. The use of questionnaires describes visual learning styles and auditory learning styles. Two numbers of the test determine mathematics problem solving ability in Polya's step, and interviews confirm mathematics problem solving ability. The data analysis techniques are reduction, presentation, and verification. Based on the results, the first subject with a visual learning style can fulfill all the indicators of Polya's steps, but another one is just three indicators. The first subject with an auditory learning style can meet all Polya's steps, but the other can fulfill three indicators.

**Keywords:** Problem Solving Ability, Visual Learning Style, Auditory Learning Style, Comparison Materials

## DESKRIPSI KEMAMPUAN PEMECAHAN MASALAH MATEMATIKA DITINJAU DARI GAYA BELAJAR

### Abstrak:

Penelitian ini bertujuan untuk mendeskripsikan dan mengetahui kemampuan siswa dalam menyelesaikan masalah matematika yang berfokus pada gaya belajar visual dan gaya belajar auditori. Subjek penelitian adalah siswa kelas VIII SMP se-Kabupaten Bulukumba. Penelitian ini bersifat deskriptif kualitatif, yang berusaha untuk mengetahui dan mendeskripsikan kemampuan pemecahan masalah matematis ditinjau dari gaya belajar siswa. Data dikumpulkan dengan menggunakan angket, tes, dan wawancara. Penggunaan angket menggambarkan gaya belajar visual dan gaya belajar auditori. Dua soal tes menentukan kemampuan pemecahan masalah matematika dalam langkah Polya, dan wawancara mengkonfirmasi kemampuan pemecahan masalah matematika. Teknik analisis data dilakukan dengan reduksi, penyajian, dan verifikasi. Berdasarkan hasil penelitian, subjek pertama dengan gaya belajar visual dapat memenuhi semua indikator langkah Polya, tetapi subjek lain

hanya tiga indikator. Subjek pertama dengan gaya belajar auditori dapat memenuhi semua langkah Polya, tetapi subjek lainnya dapat memenuhi tiga indikator.

**Kata Kunci:** Kemampuan Pemecahan Masalah, Gaya Belajar Visual, Gaya Belajar Auditori, Materi Perbandingan

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## INTRODUCTION

Education is a need that exists in the life of society, nation, and homeland. Quality and targeted education be used to improve the quality of human resources in a country. Education is a forum for activities that can be seen as a printer of high-quality human resources.

The education system is a plan or method for achieving a goal in the teaching and learning process so that students can actively develop their potential. Students will need these skills to collect, manage, and use information in order to live in a changing, uncertain and competitive environment.

Perception, attention, memory, language, problem solving, reasoning, and decision making are all internal processes in a person's mind. (Mairing, 2018). Problem solving ability is an essential part of the mathematics curriculum because students can gain experience applying their existing knowledge and skills to non-routine problem solving during the learning and completion process. This is in line with Satriani (2020), who stated that problem solving ability is an ability that students must possess.

According to Polya (Fatmawati, Mardiyana, and Triyanto 2014); (Netriwati, 2016), the stages of solving mathematical problems include (1) understanding the problem, (2) devising a plan, (3) carrying out the plan, and (4) looking back. This is meant to improve students' ability to answer mathematical problems by having them follow procedures to solve problems quickly and accurately.

Problem solving is important in mathematics education because, in everyday life, humans can never be separated from problems. Problem solving can be considered as a basic human activity (Agustina, 2016). Problems must

be found a way out by humans themselves if they do not want to be defeated by life. According to Augustine (Satriani & Wahyuddin, 2018), solving a problem is the process used to solve the problem faced. Problem solving ability is a skill so that students can use mathematics activities to find solutions to problems in mathematics, other sciences, and everyday life.

In the learning process using any model, factors always influence it. One of the factors that influence the progress of the learning process is learning style (Budiarti & Jabar, 2016; Markovic & Jovanovic, 2012). Learning styles are key to developing performance at work, school, and interpersonal situations (Kolb & Kolb, 2005). Learning and communicating become simple and enjoyable when realizing how a person absorbs and processes information (Idkhan & Idris, 2021). Even if students are at the same school or in the same class, it is important to recognize that not everyone has the same learning style. A person's ability to comprehend and retain information is diverse. Some are fast, some are average, and still, others are quite slow. As a result, individuals frequently have to use multiple methods to comprehend the same material or lesson.

One factor influencing student learning is perception, namely how students derive meaning from the environment. Hearing, seeing, tasting, smelling, and feeling are the five senses that makeup perception. The terms "learning style" and "visual, auditory, and kinesthetic" are used interchangeably in education (Papilaya & Huliselan, 2016). Vision and mental imagery are used in visual learning styles. Listening and speaking are two aspects of the auditory learning style. Large and small movements are referred to as kinesthetic learning styles (Rhouma, 2016). Students will be happier if the teacher understands their learning styles and responds appropriately to their needs. As a result, the information supplied to him will be easier to digest.

Several studies on problem solving analysis based on learning styles, such as analysis of problem solving in terms of learning styles based on Polya's step on vector multiplication material (Argarini, 2018), analysis of mathematical problem solving based on learning styles in learning (Riau & Junaedi, 2016). However, none of these studies have discussed problem solving analysis on comparative material. Based on the description above, the researcher wants to conduct a study entitled "Description of Mathematical Problem Solving Ability in Terms of Learning Styles."

## METHODS

The approach used in this research is descriptive. This research was conducted at MTs Negeri 2 Bulukumba on Jl. Education, Jawijawi sub-district, Bulukumpa sub-district, Bulukumba district. The subjects in this study were students of class VIII.1 of MTs Negeri 2 Bulukumba totaling 12 students according to the direction of the school. The researcher did not find kinesthetic subjects after being given a learning style questionnaire in this study. So they only use two learning styles. Four students are assigned from one class with details: 2 students have a visual learning style, and two students have an auditory learning style, which is then given a problem solving ability test to four subjects in the form of descriptions and conducting interviews. The instruments used in this research are learning style questionnaires, problem solving ability tests, and interviews. Furthermore, all the data collected were analyzed using qualitative data analysis techniques, including data reduction, data presentation, and verification.

## RESULTS AND DISCUSSION

This research was conducted on comparative material at MTs Negeri 2 Bulukumba class VIII.1. Learning style questionnaires and problem solving ability tests were conducted in class VIII.1. The implementation process began with observations and interviews with teachers at MTs Negeri 2 Bulukumba on September 17, 2020. Then on March 16, 2021, the researchers gave a learning style questionnaire to grade VIII.1 students. The results of the learning style questionnaire on the subjects can be seen in table 1.

Table 1. Student Learning Style Scores

No.	Initials	Visual	Auditory
1.	MH	7	8
2.	AFR	10	5
3.	WW	8	7
4.	NAP	8	7
5.	NI	6	9
6.	APR	5	10
7.	WA	4	11
8.	NM	6	9
9.	MN	9	6
10.	NA	11	4
11.	PN	7	8
12.	HH	6	9

From table 1, it is found that the students who filled out the learning style questionnaire were 12 students who were allowed to come from the school to the researchers. Next, two subjects were selected for each learning style. The choice of this subject refers to the score obtained, the students as subjects must have points or scores of more than or equal to ten, be able to communicate well when expressing opinions/ideas orally or in writing, and be willing to participate in the whole process of collecting data in this study. The selected research subjects are presented in table 2.

Table 2. Selected Research Subjects

Type of Learning Style	Initials	Code
Visual learning style	AFR	SV1
	NA	SV2
Auditori learning style	APR	SA1
	WA	SA2

Each answer and dialogue or chat is assigned a specific code to facilitate data analysis. The interviewer's dialogue excerpt is coded "P", while the subject's dialogue except is coded for the first two digits of the subject's learning style. Furthermore, each dialogue after one digit is the first and second subject code, the two digits behind both the interviewer and the subject are the code number of the questions discussed. For example, for the interviewer, "P-01" means the code of the question from the interviewer for the first question. Likewise with the subject, "SV1-02" means the symbol of the question from the visual learning style subject for the first subject in the second question.

The following describes comparative material's mathematical problem solving ability in terms of visual and auditory learning styles in class VIII students of MTs Negeri 2 Bulukumba.

### 1. Mathematical Problem Solving Ability Viewed from Visual Learning Style

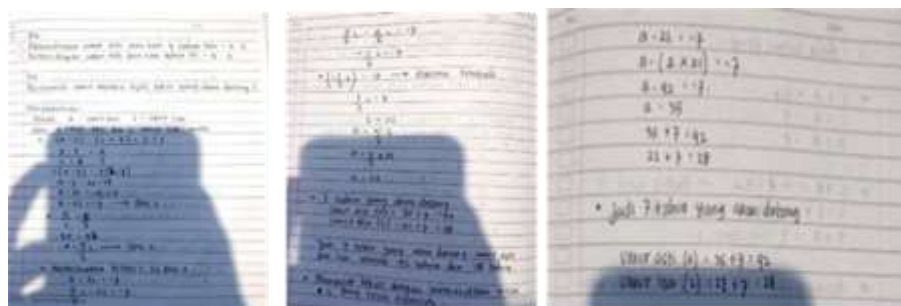


Figure 1. The Answer of Subject 1 with Visual Learning Style

By reading the question once and quickly recognizing and writing down the beginning knowledge that is known and asked in the question, SV1 demonstrates that he grasped the problem. The material is presented logically and sequentially to make it easy to understand and choose the next steps. Subject admits that he understands better if it is assumed and a mathematical model is formed. Subject admits that it is no longer difficult to solve the problems in the questions asked at the stage of compiling a plan for the completion. For example, what is known to form a mathematical model, when confirmed through interviews, the subject admits that he understands better if it is assumed and a mathematical model is formed. So, in the stage of carrying out the plan, the subject is no longer difficult to solve the problems in the questions asked. The subject was re-examining at the looking back stage, checking for known variables to obtain other variables, and the subject was confident in the answers he received.

The figure consists of two photographs of handwritten mathematical work on lined paper. The left photograph shows a table with two columns: 'Diketahui' (Known) and 'Ditanyakan' (Asked). Under 'Diketahui', there are several lines of text and numbers. Under 'Ditanyakan', there is a question. Below the table, there are several lines of algebraic equations and calculations, including fractions and variables like 'x' and 'y'. The right photograph shows a similar table with 'Diketahui' and 'Ditanyakan' sections. Below the table, there are calculations for 'X', showing 'X = 35'.

Figure 2. The Answer of Subject 2 with Visual Learning Style

Based on the results of tests and interviews on the subject SV2, the subject understands the problem well by repeating the known and asked questions. When devising a plan, the subject assumes what is known in the problem and creates a mathematical model, which makes the problem easier to solve. The subject had difficulty fixing the problem while carrying out the plan, and he could not explain what he was doing in detail. Furthermore, subject do not double-check or re-evaluate their written answer.

Research by Umrana, Cahyono, and Sudia (2019) explained that the visual subject to Polya's first indicator is that the visual subject can express and write down what is known and present what is being asked. Visual subjects can make representations in the form of images, even though the images made are not complete enough when viewed by others in both problem 1 and problem 2.

The visual subjects were originally unable to reveal all of the formulae that would be utilized to solve the problem during the planning stage, but following a follow-up interview, the visual subjects were able to plan all of the formulas that would be used to solve the problem. Several elements include, for example, the researcher's lack of understanding of the visual subject's intent and the visual subjects' learning style character, which includes forgetting to send verbal messages to others unless they are written or read directly.

Even though there was a calculation error in executing the formula in the first problem, the visual subject can complete all of the steps that had been intended. This error occurs not because the visual subject is less capable of performing multiplication and division, but rather because the subject is not careful when performing calculations, as evidenced by the visual subject's ability to solve other problems by correctly performing calculations according to the formula used.

Visual subjects could re-examine the results of problem solving. The visual subject re-examines the responses obtained by clawing from the beginning to the conclusion.

## 2. Mathematical Problem Solving Ability Viewed from Auditory Learning Style

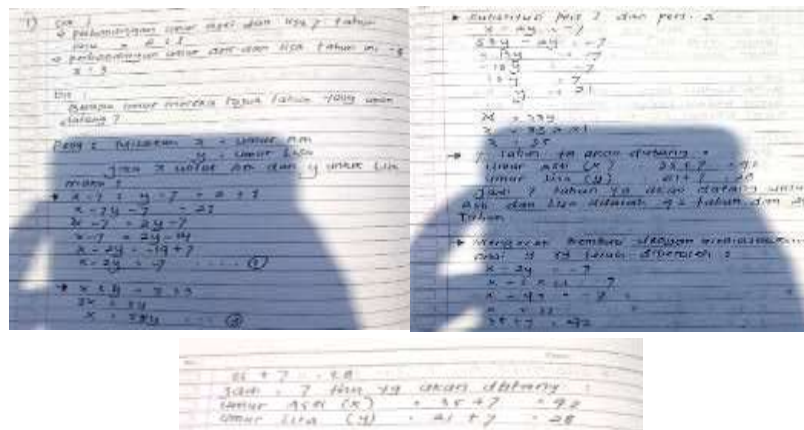


Figure 3. The Answer of Subject 1 with Auditory Learning Style

Based on the test and interview results, it can be shown that the subject SA1 reads the questions multiple times before answering them, especially when there are words that SA1 does not understand. Subject SA1 can start with the things that are known in the problem and then go on to the questions. This demonstrates that the subject first comprehends the problem before formulating plans. The subject SA1 can determine the solution after



understanding the problem. The SA1 was able to explain how he arrived at the final answer by following the established completion processes. After re-reading their work and reviewing the answers, SA1 believes that the answers they got are correct.

Dik:
 

- Untuk setiap liter Air dan Lada 7 tahun Cadre = 211
- Untuk setiap liter Air dan Lada tahun ini = 13

 Dit:
 

- Besarnya umur masing-masing 7 tahun yang akan datang?

 Penyelesaian:
 

- misal: a = umur Air, b = umur Lada
- Jika a umur Air dan b umur Lada, maka
- \*  $(a-7) + (b-7) = 211$
- $a + b - 14 = 211$
- $a + b = 225$  (Persamaan 1)
- \*  $a - 7 = 13$
- $a = 20$
- \* Substitusikan Persamaan 1 ke Persamaan 2
- $a - 7b = -7$
- $\frac{1}{3}b - \frac{6}{3}b = -7$
- $-\frac{5}{3}b = -7 \rightarrow \text{Mangkalang: kembali}$
- \* Maka  $\frac{1}{3}b = 7$
- $b = 21$
- $a = \frac{5}{3}b$
- $a = \frac{5}{3} \times 21$
- $a = 35$
- \* Maka 7 tahun yang akan datang
- umur Air (a) =  $35 + 7 = 42$
- umur Lada (b) =  $21 + 7 = 28$

Figure 4. The Answer of Subject 2 with Auditory Learning Style

Based on the exposure of test and interview results for questions number 1 and 2 on the subject SA2, it can be seen that the subject reads the questions first, then writes down what is known and asked in the questions. SA2 understands the problem first before making plans. After understanding the problem, the subject can determine the solution to solve the problem. SA2 was still unsure of what to do due to a lack of understanding of the material provided, but SA2 believed that the answers obtained were correct but did not re-check the answers that had been obtained.

From research conducted by Purwaningsih and Ardani (2020) explained in auditory subjects that the first indicator of Polya is that SA is able to understand problems well, including being able to express and write things that are known, able to present things that are asked, able to make representations in the form of pictures, even though pictures made by SA not complete enough to be seen by others in both question 1 and question 2.

SA can plan problem solving well. Able to plan what steps are important and mutually supportive to solve the problems encountered correctly and plan the formula that will be used in solving the problem, but there is an incorrect formula planned in problem 2.

At the stage of implementing the problem solving plan, the SA can carry out all the steps that are important and mutually supportive to solve the problems encountered following what has been planned and written down step by step. SA can perform calculations well according to the formula used,



but there is an incorrect formula written in problem 2, causing the calculation results to be wrong and the desired answer is wrong. This error is caused by wrong planning.

SA's concentration is often disturbed when researchers hold questions and answers while working on questions, where the character of SA's learning style is easily disturbed by noise, so to anticipate this, the results obtained are scratched repeatedly by SA. SA can re-examine the results of problem solving obtained by scratching from beginning to end. In addition to this method, SA is also able to prove the final results obtained by pulling back the flow (stage) of the process. In this case, the formula used is modified or pushed back until the values contained in the given problem are obtained. Sa knew this method without direct explanation from the teacher.

Table 3. Result Description of Mathematical Problem Solving Ability of Subjects with Visual and Auditory Learning Styles

<b>Problem Solving Indicator</b>	<b>Subjects with Visual Learning Style</b>	<b>Subjects with Auditory Learning Style</b>
Understanding the problem	Can write down what information is known and asked properly and accurately, both SV1 and SV2 subjects.	Can write down what information is known and asked properly and precisely, both SA1 and SA2 subjects.
Devising a plan	Can identify and develop mathematical models well, subjects SV1 and SV2	Can identify and develop mathematical models well, subjects SV1 and SV2
Carrying out the plan	Subject SV1 can use the right strategy and are confident with the answers that have been done, while SV2 uses the right strategy but are not sure about the answers that have been done.	Subject SA1 can use the right strategy and are confident with the answers that have been done, while SA2 is using the right strategy but is not sure about the answers that have been done
Looking back	Subject SV1 can make conclusions and evaluate the answers obtained, while SV2 cannot make conclusions and evaluate the answers obtained	Subject SA1 can make conclusions and evaluate the answers obtained, while SA2 cannot make conclusions and evaluate the answers obtained

## CONCLUSION

Based on visual learning styles, SV1 can meet four problem solving ability indicators according to Polya's steps: understanding the problem, devising plan, carrying out the plan, and looking back, whereas SV2 can only meet three problem solving ability indicators: understanding the problem, devising plan, and carrying out the plan. Based on the auditory learning style, SA1 can meet four problem solving ability indicators according to Polya's steps: understanding the problem, devising plan, carrying out the plan, and looking back, whereas SA2 can only meet three problem solving ability indicators: understanding the problem, devising plan, and carrying out the plan.

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